SCIENTIFIC AMERICAN

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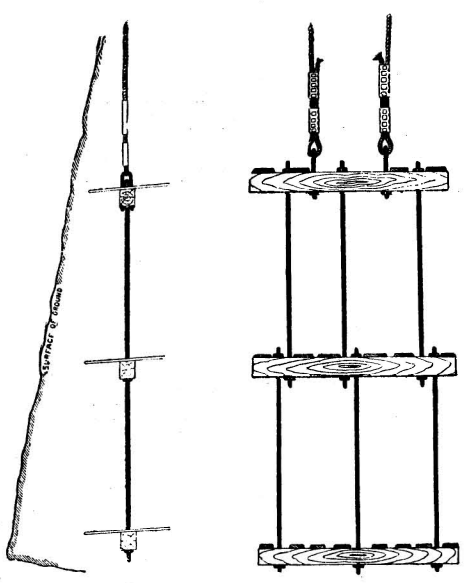
THE AERIAL CABLE RAILWAY.

A wire rope tramway for passenger car service over the Tennessee River, at Knoxville, and which is suspended at a height of 350 feet above the water as it reaches the south side of the river, as shown in our illustration, has been in practical use for some time past, passengers being conveyed thereby to a pleasure resort back of the bluff on the other side of the river from the city of Knoxville. The starting point of this suspended railway is only about five minutes' ride by street cars from the center of the city, and here is a power house where are two twenty horse power engines which operate the hauling cable. The tramway cables are each 1⅜ inches in diameter, and the length of the span is 1,060 feet. These cables on the Knoxville side are anchored to 12×12 inch oak timbers, 14 feet long, placed behind plank bulkheads. The connecting bars are 12 feet long and 1¼ inches thick, and provision is made for taking up the slack by means of the long threaded screws, as shown in the plan and side view of the anchor. The anchor at the high end, on the opposite side of the river, consists of iron plates fixed in the rock. The supporting cables each have a breaking strain of 60 tons. The cable conveying the motive power is ½ inch in diameter and permanently fastened to the car. The car, empty, weighs 1,200 pounds. It has a 14 foot body and 3 foot platforms, and is 6 feet wide by 6½ feet high. The seating capacity is 16 passengers. The car is provided with automatic brakes, which stop the car in case the propelling cable breaks or slips on the drum. The up trip takes about three and a half minutes. The descent is made in a half minute by gravity.

An accident occurred on this aerial ferry on Sunday, February 18, by which one passenger was killed and two others slightly injured. The hauling cable broke just as the car reached the top of the incline, and struck the car with such force as to damage it somewhat, the car then starting rapidly down the grade until it was stopped by the automatic brakes. When the car was brought to a standstill it was at a point about 200 feet above the water, and the eight passengers it



PLAN AND SIDE VIEW OF ANCHOR.

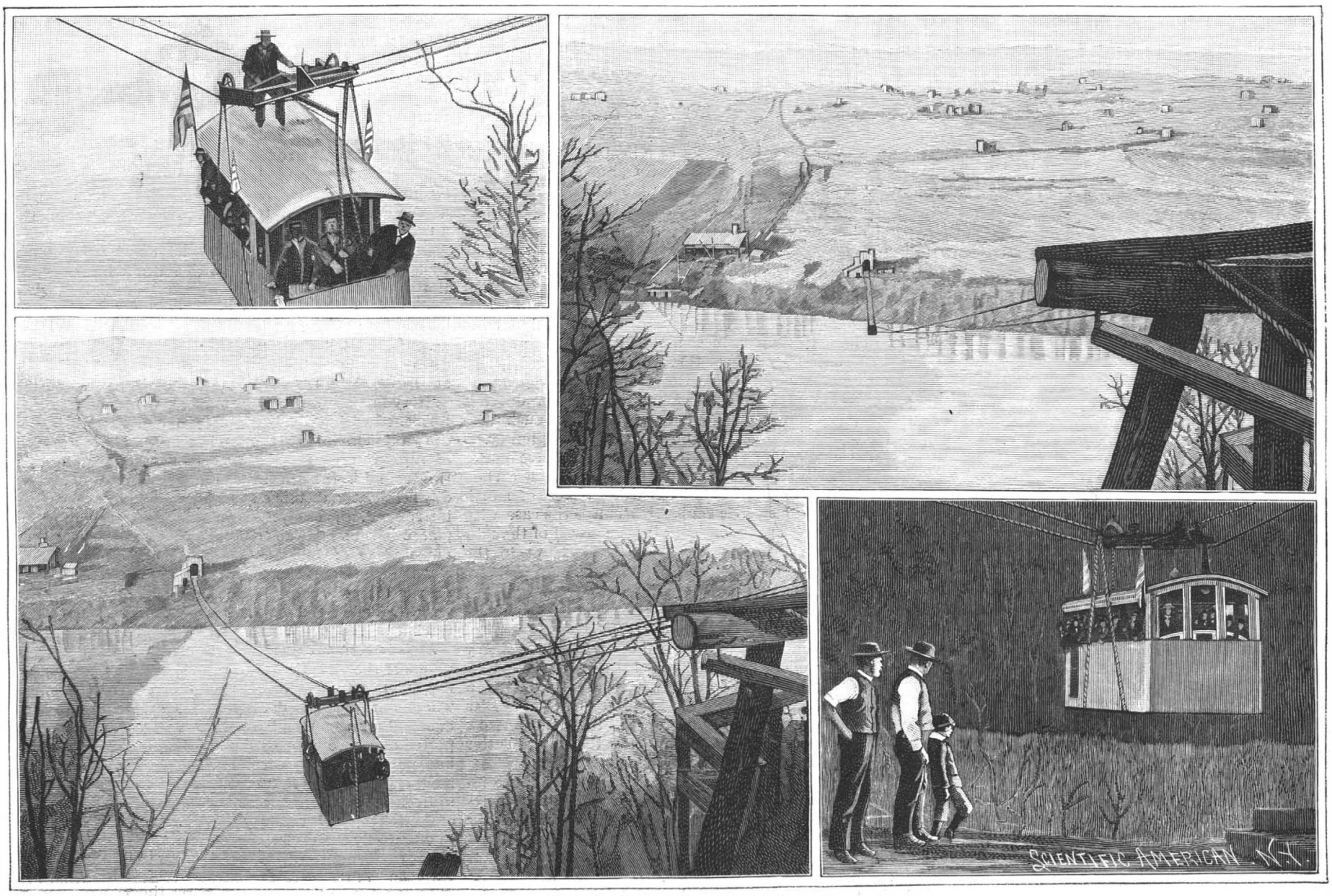
contained were rescued by being let down by ropes into a boat on the river.

Golden Relics in Mexico.

A discovery of great scientific interest has been made in excavations being carried on in the district of Tlaxiaco, State of Oaxaca. A number of small images, formed in metal, were uncovered by the workmen in one of the oldest ruins a few days ago. The images represent people of Oriental appearance and dress, as well as priests in their robes of sacrifice. They bear hieroglyphics of unknown characters and are elaborately wrought, with fine art lines shown in every curve. The images found thus far are of gold, either wholly or in part, and are coated with some unknown enamel, which has preserved them from all harm in the many years they have been buried in the soil. They will probably be shipped to the National Museum in the city of Mexico, where they will be placed at the disposal of the scientific world for further study and discussion. The find is the most important of the year in the domain of antiquities, and preparations are now being made to conduct a complete exploration of the Tlaxiaco ruins for further evidence of the ancient civilization which is known to have flourished in Southern Mexico. —*N. Y. Times.*

Foreign Visitors at the World's Fair.

An examination of steamship statistics for 1893 shows that the Chicago Fair failed to attract to the United States any extraordinary number of foreign tourists. As a matter of fact, the number of cabin passengers landing at the port of New York last year was only 838 greater than the number who landed in 1892. It is known, however, that there was a falling off in the number of American tourists to Europe, and as fewer Americans went abroad, fewer returned, and the fact that there was an actual increase in the number of cabin passengers arriving from foreign ports is evidence that a larger number of foreigners landed than in former years. But this number was nothing like as much as was expected. The number of immigrants arriving in the United States in 1893 was 35,601 less than in 1892. There were more Italian immigrants than any other nationality. The Italians numbered 69,074, the Germans 55,981, and the Irish 30,236. Statistics as to the financial standing of the emigrants have been kept in detail only since July 1, 1893. Since then $2,100,000 was brought into the country by the immigrants.



THE AERIAL CABLE RAILWAY, KNOXVILLE, TENN., 350 FEET HIGH.

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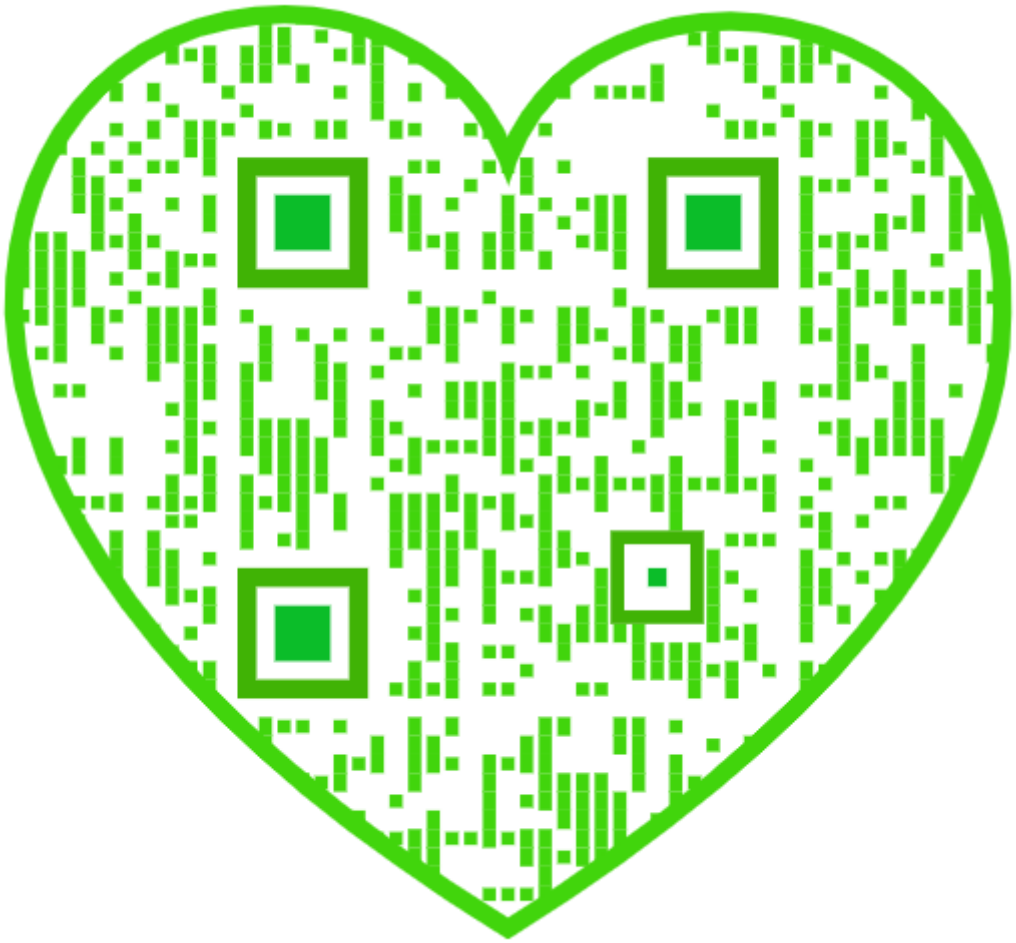

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Contents.

(Illustrated articles are marked with an asterisk.)

Aluminum 163
Aluminum bronze 167
Antwerp International Exposition, the* 171
Athletics, school 163
Bauxite mining, Alabama 162
Bicycle race, international 168
Books and publications, new 172
Bricks, slag, the manufacture of 167
Buildings, tall, vibrations of 171
Cable railway, aerial* 161
Camels, wild, in Arizona 170
Caucasus, excavations in 163
Cotton ginning machinery* 164
Copying from nature 170
Dirigo—American steel sailing ship* 168
Ditching machine, Harvey's* 164
Eggs, Australian 167
Electrical engineer's problems 162
Electric arc action on diamonds. 167
Electric motor, a home-made 170
Electric motor, the most powerful 169
Engines, ancient reaction* 165
Exposition, the Antwerp* 170
Flooring, maple 163
Gun, quick-firing, new 163
Ice floe, at sea on an 166
Indiana, the new battle-ship* 167
Influenza spread by contagion 168
Inventions recently patented 172
Lantern showing pictures in natural colors* 169
Motor, a simply made 170
Notes and queries 173
Patents and population 165
Patents granted, weekly record. 173
Photography and its rights 166
Photography tricolor* 169
Pipette, Geiner's automatic* 167
Post hole borer, Morris'* 164
Railway, aerial* 161
Railway appliances, some new 172
Railways, N. Y. elevated, train service of 164
Relics, golden, in Mexico 161
Rooster, a, in the pulpit 170
Saccharin 167
Shooting through solid steel 163
Telephones, experiments with 162
Tooth brushes and toothpicks 168
Vibrations of tall buildings 171
Warm, how to keep 170
Water power of Augusta, Ga 170
Weighing 165
Wells, air lifting process for* 165
Work holder for grinding precious stones, Linden's* 165
World's Fair foreign visitors 161

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 950.

For the Week Ending March 17, 1894.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AERONAUTICS.—Paper Birds.—A Simple toy aeroplane, illustrating the possibilities of artificial flight.—2 illustrations 15184
II. ARBORICULTURE.—Sassafras Trees.—By WALTER J. QUICK.—Extrordinary growth of different trees of this species in Missouri. 15186
III. BIOGRAPHY.—Joseph Wilson Swan.—The work of Swan in the invention of the incandescent electric lamp 15181
William Shotton.—A magnificent achievement by a boy 18 years of age, bringing a fever-stricken four-masted bark safely into port.—1 illustration 15181
IV. CHEMISTRY.—Experiment on the Crystallization of Sulphate of Soda.—A simple and interesting experiment on crystallization.—1 illustration 15186
The Essential Oil of Lemon.—By R. S. LADELL.—Analyses of this essential oil when without terpenes 15186
The Methods of Testing Fats and Oils.—By Dr. ERNEST MAILLAU.—A second installment of this elaborate article 15185
The Rusting of Iron and Steel.—An interesting article on the phenomena of rusting 15182
V. ELECTRIC ENGINEERING.—Electric Hauling at the Mines of the Brock Coal Company, Pa.—Application of electricity in a Pennsylvania coal mine 15181
VI. FINE ARTS.—The Art of Book and Newspaper Illustration.—By HENRY BLACKBURN.—A valuable paper on the subject of the wood engraver and artist 15175
VII. HORTICULTURE.—Horticulture and Vegetable Novelties of the Season.—New flowers and ornamental plants and vegetables.—16 illustrations 15187
VIII. IRRIGATION.—Irrigation by the Use of Windmills.—By B. A. MCALLISTER.—Government report on the use of windmills in Western States 15189
IX. METEOROLOGY.—Wind Pressure.—Experiments on wind pressure.—A valuable research for the engineer 15182
X. MISCELLANEOUS.—An English Ferris Wheel.—A projected wheel for London, 300 feet high.—1 illustration 15182
Visiting a Chinese Patient.—Experience of a lady physician with a Chinese patient 15190
XI. NAVAL ENGINEERING.—H. M. S. Havock, Torpedo Boat Destroyer.—Description of a remarkably fast addition to the British navy 15181
XII. ORDNANCE.—Powder for Cannon.—Recent smokeless powders for heavy guns 15180
XIII. PHYSICS.—Viscosimetry.—Recent elaborate experiments on liquid friction.—Details of the apparatus.—6 illustrations 15183
XIV. PYROTECHNY.—The Manufacture of Fireworks in France.—Triumphs of the pyrotechnist's art.—1 illustration 15179
XV. SANITARY ENGINEERING.—New Pipe Joint.—A substitute for wiped joints in plumbing practice 15179
XVI. SURVEYING.—The Angleometer.—An artificial horizon instrument for taking the altitude of celestial objects.—1 illustration 15179
Pantometric Guide Compass.—A useful pocket compass for rapid photography in the field.—4 illustrations 15178
XVII. TECHNOLOGY.—Bleaching Oils.—Linseed and similar oils and their treatment 15177
Cottonseed Oil Rubber.—By C. B. WARRAND.—An India rubber substitute made from linseed oil 15178
Large Cotton Mills.—The famous Amoskeag Mills at Manchester, N. H., described 15180
Manufacture of Nitro-Glycerine.—Notes on the manufacture of this explosive 15179
The Boiling of Linseed Oil.—A preparation for drying oils for paint 15177
XVIII.—WORLD'S COLUMBIAN EXPOSITION.—Conflagrations of World's Fair Buildings.—Illustration of the great fire at Chicago, destroying some of the great Fair buildings.—1 illustration 15175

THE DIFFICULTIES AND PROBLEMS OF THE ELECTRIC ENGINEER.

One of Germany's greatest philosophers, now many years dead, affirmed that electricity was destined to serve the minor uses of life. Up to a recent period this observation was wonderfully just. In spite of the work of Page and others the electric motor remained for years little better than a toy. In metallurgy the deposition of thin coatings of metals was all that electricity effected; in the production of light and heat its work was nothing; and the electric telegraph was the most impressive exhibition of its power. Now all is changed. In all technical departments the work of electricity appears—often on the greatest scale. In welding metals and in the arc light the larger class of heating and lighting operations are effected; in the Cowles and other electric furnaces, metallurgy and heating find their exponent, while in the transmission of energy electricity is with out a rival in the magnitude of its operations and in the number of horse powers of energy conveyed to points distant from the place where the energy is generated. The effect of the new *regime* and of the unprecedented developments upon the public has had its effect, and electricity is believed to be almost omnipotent.

Yet the German philosopher's observations have even to-day a glimmer of truth in them, because of the limitations of electricity. None of the phases of energy has drawn for it more provoking limits. Repeatedly experiments in the larger class of operations have been tried only to fail, because the limitations of the subject were poorly understood. By a survival of the fittest, and by gradual improvement in detail, the present appliances of what may be termed electric engineering have been produced and have found their place in the world's work.

In the transmission of energy one of these limits is found. Ordinarily a mechanical transmission system works more economically, as it does more work. Thus a cable traction plant kept in motion and propelling no cars works at a total waste; every car put upon the line increases its efficiency, and the efficiency keeps approaching the hundred per cent limit as car after car is added. In the electric transmission of power, as usually conducted, the case is exactly the reverse. Every increase in energy transmitted involves a greater waste upon the line. The only way to bring about economy is to have the resistance of the line low as compared to that of the lamps and motors absorbing the energy transmitted. Of course, this may be counteracted to some extent by the greater economy in generation of large quantities of energy at the station, but the limits to the economy of transmission proper remain. A line supplying lamps or motors in parallel with each other will work to constantly increasing disadvantage as greater draughts are made upon the line. The case is comparable to the "wire drawing" of steam, where a large engine is fed by too small a pipe. For a given steam pipe, the larger the engine supplied by it, the greater will be the waste.

Recently many attempts have been made and carried out to use the current as a heating agent. Again the question of economy appears, and for the present seems to preclude the extensive use or any except special applications of the current for heating purposes. The generating plant is usually run by steam. Coal is burned and its energy is employed to drive a steam engine which drives a dynamo. The dynamo may have an efficiency of ninety-eight per cent; the boiler may have an efficiency almost as great; but the steam engine, subject to the second law of thermo-dynamics, at one fell swoop reduces the efficiency of the system to perhaps only two or three per cent. Burning coal under a boiler and using the steam power to generate electricity, and using the current as a heat producer, is comparable to running a hot air furnace on such principles as to send nearly all the heat up the chimney.

It would seem as if the thought that a horse power of energy is required to keep a few feet of fine carbon filament white hot would be a subject almost of mortification to the electric engineer. This is the case with incandescent lighting. That it is a subject of thought with him, that he does hope for improvement in the future, is evidenced by the eagerness with which researches on the direct production of light are watched. The electric world, in a sense, is waiting for the inventor or scientist who will produce the Hertz waves of frequency sufficient to affect the eye. The inefficiency of the incandescent lamp is so fully recognized that the glow-worm, firefly and curculio are looked upon as models of efficiency in light production—examples too near perfection perhaps for man to aspire to follow—yet as examples which may show the way to better results in the future.

The want of suitable refractory material for the incandescent lamp filament, the high capitalization required for electric generating plants, the poor economy of the steam engine as a prime motor for driving dynamos, are a sample of the difficulties which the electric engineer has to contend with. It is to be hoped that the inventor will dispose of enough of them to make electricity take the place it is fairly entitled to.

BAUXITE MINING IN ALABAMA.

The growing importance of aluminum gives interest to the ore from which it is obtained. This ore derives its name, beauxite or bauxite, as it is more commonly called, from the town of Beaux, or Baux, near Arles, in southern France, where it has been found in large quantities.

Within recent years it has been discovered in Tennessee, Virginia, both the Carolinas, Georgia, Alabama and Arkansas.

An article by Henry McCalley, in *Science*, is our authority for the following statements concerning the present status of the mining of the ore in the South.

Of the four companies which have been engaged in the industry, only two are now operating. They are known as the Republic Mining and Manufacturing Company and the Southern Bauxite Mining and Manufacturing Company.

But three mines are being worked at present; they are all near Rock Run, Alabama. An average sample of the ore from one of these mines shows on analysis about this composition:

Alumina	61·00
Ferric oxide	2·20
Silica	2·10
Titanic acid	3·12
Water	31·58

Samples from the other mines differ a little from this; they yield from three to five per cent less of alumina. The mining is easy, as the ore is soft and can generally be taken out with a pick; it is, however, rather expensive, as the ore varies so much in quality that it must be carefully sorted by hand and with the screen.

The diggings are on side hills, and are drained by open ditches. The ore whose analysis has been given is about 35 feet thick in the mine. It is concretionary; the best of it is found in a middle seam four or five feet thick.

Owing to its hydroscopic property all the ore has to be dried before it is shipped.

This is done by spreading it out in the open air, for the action of sun and wind.

When favorable tariff legislation makes it safe to increase the working capacity of these mines, artificial means of drying and better drainage facilities will be adopted.

At present only the best grade of ore is shipped. It is used for the manufacture of alum, which could as well be made from the inferior ore now lying in heaps about the mines, but to compete with the cheap imported ores, sent over by men who had the entire business in their hands, before these mines were open, only the best product can be put upon the market.

EXPERIMENTS WITH TELEPHONES.

The telephone invention now being public property, no impediment is offered to the free use of the instrument for business, social and scientific purposes. This, together with the fact that the very best telephone can be bought for less money than is required for the materials or parts from which it is made, places everybody on an equal footing as regards the use of this interesting instrument.

The telephone is incapable of producing any very striking physical results beyond transmitting speech, as the current generated by the telephone used as a transmitter is almost infinitesimal. Still there are many interesting experiments which may be performed by means of two telephones with suitable line connections.

To use the telephone to advantage, a call of some kind is required for signaling. The simplest device for this purpose known to the writer consists of a battery at each end of the line, a ratchet bar mounted so as to act as a switch for cutting out the telephone, and a battery having one pole grounded while the other is furnished with a blade of spring metal which may be drawn quickly along the ratchet bar, making a series of rapid interruptions of the current, producing a rattling sound in the distant telephone, which can be readily heard at a distance of from 25 to 40 feet from the instrument, especially if a trumpet-shaped resonator be placed in such relation to the telephone as to allow the mouthpiece of the telephone to rest upon the smaller end of the resonator. A toy tin horn cut off at the proper diameter answers well for this purpose. A screw-threaded rod serves very well indeed for the ratchet bar.

An interesting experiment is transmission by telephone of the vibrations of a tuning fork at one end of the line to a tuning fork at the other end of the line. The mouthpieces and diaphragms are removed. At one end of the telephone line a tuning fork is supported on a resonator with one of its prongs very near, but not in contact with, the pole of the telephone magnet. A tuning fork of the same pitch is vibrated in front of the telephone magnet at the opposite end of the telephone line. The fixed tuning fork is made to vibrate by the variations of magnetism produced by the current induced in the transmitting telephone by variations of magnetism produced by the vibration of the fork at the transmitting end of the line.

By means of two telephones, one with a diaphragm,

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the other without, the speed of machinery may be indicated at a distance. The telephone without the diaphragm is placed with the pole of its magnet very near the iron arms of a revolving wheel, or it is placed near a wooden wheel carrying a number of armatures. As the wheel revolves, the arms or armatures in passing the pole of the telephone produce changes of magnetism which induce electric pulsations in the winding of the telephone magnet. These electric pulsations affect the strength of the magnet of the distant telephone, thus causing the diaphragm to vibrate, producing in the telephone a musical sound, the pitch of which depends on the speed of the machinery. The pitch being ascertained by comparison with a pitch pipe or similar instrument, the speed is found by a very simple calculation.

By attaching to the mouthpiece of a telephone a cork having in it two perforations, in one of which is inserted a small glass tube drawn down so as to form a gas jet, having an aperture as fine as a cambric needle, while in the other perforation is inserted a right-angled tube for receiving a small rubber gas tube, a manometric flame apparatus is constructed in which the vibrations of the receiving diaphragm will be shown by vibrations of the gas flame, these vibrations being analyzed by means of a revolving or swinging mirror, according to the well known method. Probably the best material for fastening the perforated cork in the telephone mouthpiece is beeswax.

Excavations in the Caucasus.

A lecture was given recently before the Glasgow Archæological Society by the Hon. John Abercromby, on "Some Recent Excavations in the Caucasus." He said the Caucasus had long been a wonderland. In Greek fable it was famed as the land of the Golden Fleece, as the place of punishment of the overbold Prometheus. It used to be considered the center of dispersion of European peoples, and until recent times it was regarded as the region where the art of metallurgy originated. His paper was devoted to a description of some of the more recent excavations that had been made on both sides of the great chain of the Caucasus, and on the adjoining district of Russian Armenia. Premising that archæologists are inclined to the belief that the Caucasus was uninhabited before the arrival of the use of metals, he proceeded to describe in detail the results yielded by the examination of places of interment, and afterward summarized the conclusions of M. Chantre with regard to those belonging first to the earlier period, which he placed between 1500 B. C. and 700 B. C., and second to the later or Scytho Byzantine period, which dated from about 700 B. C. to 700 A. D.

The majority of the forms and decorative motives of the cemeteries of the iron age in the Caucasus and in all Europe were, if not identical, so analogous that we were bound to attach them to the same civilization. It was interesting to find incrustations of iron in bronze in the Caucasus, in Switzerland, and Austria; to find daggers with antennæ identical with those of Hallstaldt; to find torques like those of Bosnia and Jura, belts of thin stamped bronze and pendants of forms thought to be peculiar to the Tyrol, spirit armlets like those in the Alps and on the Danube.

While this was the opinion of M. Chantre, Professor Kondakoff, Count J. Tolstoi, and M. Reinach, with fuller knowledge and writing six or seven years later, came to the conclusion that a number of objects found north of the Caucasus showed an analogy with others from southern Russia belonging to the first centuries of our era. They would not admit that the Caucasian finds were anterior to the Christian era. Mr. Abercromby next proceeded to describe the explorations of M. De Morgan in the years 1887 and 1888 of five cemeteries situated to the south of the Caucasus in a line drawn from Batoum on the west to Baku on the east. These cemeteries represented four distinct periods, the oldest from 2500 B. C. to 3000 B. C., and the latest belonging to the seventh and fifth centuries B. C. M. De Morgan divided the 250 tombs opened by him into four classes—(1) dolmens of large dimensions containing bronze weapons; (2) kists or small dolmens containing bronze arms of a later period; (3) kists of a transition period in which iron began to be used; and (4) kists containing iron alone. The oldest dolmens were found on mountain tops, even at an elevation of 9,000 feet, either isolated or in groups. In these the arms were of bronze, consisting of long two-edged swords, daggers, lanceheads, arrowheads, and axes. Ornaments were rare, and included necklaces of cornelian beads and blue porcelain bangles and pins of bronze. One necklace contained a well polished agate engraved with *Vos zebu*, which seemed to indicate relations of some kind between India and the northwest of Persia in the bronze age. The pottery was coarse and without ornament. The mortuary furniture of the second class was rich and artistic, that of the third less so. With the appearance of iron a great change took place. Bronze weapons were gradually replaced by swords, poniards, and spears of iron. Pottery affected the forms of birds, oxen, and horses. From the similarity of the dolmens of the first inhabitants with those found in India, throughout Europe, and in the northwest of the Caucasus, M. De Morgan believed that they were probably all constructed by different tribes of the same Aryan race.

School Athletics in Relation to Mental Training.

The mere circumstance that discussion has long been and still is active in seeking to define the true position of physical exercise in relation to mental training should suffice to prove the essential nature of the connection which binds together these diverse methods of education. Each is in its own place indispensable, and this fact happily is in a greater or less degree recognized in every school curriculum, even the most humble. The reason is not difficult to find when we consider how closely and inseparably associated is the health of the mind with that of the body. It is not in the nature of things that we should be capable of sustained and vigorous mental activity unless due provision be made for the purification and nutrition of tissue, including that of the brain, by means of an active blood circulation. The relation between the latter and muscular energy requires no explanation. It is true that bodily activity does not confer mental power or even encourage mental exertion. It is also true that exceptional powers of mind have displayed themselves in persons physically weak; but neither of these admissions affects our present argument, which maintains the certain advantage resulting to all mental processes, ordinary or exceptional, from that which promotes the health of their nidus in the brain. A further benefit conferred by physical training is its influence upon character. A host of mushroom frailties, vices, and foibles break down in the presence of such vigorous growths as the resolution, the endurance, and the manly self-reliance engendered by a habit of orderly and energetic action. Justice, fairness, and fellow-feeling are developed by the same wholesome training, and thus many a boy at school acquires almost unconsciously that living force of character without which intellect is but a brittle gem. For obvious reasons our public schools have taken a leading part in promoting physical education in this country. The pupils trained in them are, in very many cases, resident, and the consequent responsibility for their bodily health imposed upon teachers who act in loco parentis has no doubt had to do with the formation of a compulsory system of exercise. Administered with due regard to individual fitness or unfitness, we regard this arrangement as beneficial, and we welcome the development of a similar, though naturally somewhat less stringent, method in the management of day schools throughout the country. Into the comparative merits of the particular means employed we cannot now enter. It is enough that the principle which they express is generally admitted, and that those who now administer education are for the most part firmly convinced of its importance as a power to be regulated and employed for the mental as well as the physical well-being of those under instruction.—*The Lancet.*

Maple Flooring.

Among the noteworthy features of recent lumber trade development is the rapidly increasing demand for maple flooring. Improvement in the method of manufacture has kept pace with the growth in demand for product; or perhaps it is more exact to say that the recognition of maple flooring has been forced on the attention of consumers by the enterprise of manufacturers in turning out a perfected product and urging it on public attention. A few years ago all the maple flooring used was worked out on orders by a few planing mills. The hardwood dealers carried maple strips in their yards and had them dressed and matched when they happened to receive an order for flooring. Now great manufactories have been established for the sole purpose of producing maple flooring. Exact, strong and swift machinery has been invented to work out the stuff. The boring machine has rendered nailing easy, and now comes the end-matching invention. Maple flooring has come to be regarded as the thing indispensable in most public buildings and is used largely in private dwellings. Such an extent has the demand reached that the larger dealers are obliged to make contracts for millions of feet far in advance of requirement, the same as is done with pine or any other wood of extensive sale and consumption in the building trades and manufacturing.

The demand for maple flooring in its phenomenal growth suggests that the timber out of which it is produced cannot last forever. There is a limit to the supply of maple, almost in sight, unless the forests shall be bought up and reserved from denudation by farmers, who see more value in the soil than in the timber. But if maple must go rapidly, there is consolation in the fact that yellow pine and Pacific coast fir are both good flooring woods, while oak is not to be despised. Come to think of it, several generations yet unborn will be able to tread on good hard floors before the timbers to make them shall be exhausted.—*N. W. Lumberman.*

A New Quick-firing Gun.

The new Salvator mitrailleuse, or quick-firing machine gun, having been adopted by the Austrian military authorities, a number of pieces have been manufactured, and are reported to be ready for distribution. The gun is not intended for use in the field, as in the case of the English Maxim and Nordenfelt machine guns, but will be mounted stationary on the outworks encircling important fortresses. It is said to be only half the weight of the Maxim, and its average rate of discharge is about the same—300 rounds per minute, with a maximum of 320. The diameter of the bore is 8 millimeters, being similar to that of the Mannlicher repeating rifle now in use in the Austrian service. The barrel is not incased in a water jacket, and 1,200 continuous rounds can be fired before it shows the effects of the excessive heat. The cartridges are supplied, as in the Nordenfelt, from a large hopper fixed above the firing chamber. The gun is fired by means of an ordinary trigger, with trigger grip, and a recoil spring supplies the automatic action. But the principal point of interest in respect of which the new gun differs entirely from the mechanism of similar weapons now in use in other countries is the oscillating pendulum regulating the speed of fire. There are two firing commands with the Maxim—single fire and continuous fire. The discharge is regulated by the turning of the crank handle. The single fire is as the fire from an ordinary repeating rifle, while continuous fire represents the most rapid discharge of which the machine is capable. With the Salvator mitrailleuse, however, the great advantage is gained of sustaining a moderately heavy discharge of 30, 50, to 100 rounds per minute, and increasing it by means of a faster oscillation of the pendulum to 300 when a dangerous phase of attack has been developed.

Shooting Through Solid Steel.

The futility of piling steel armor plates on war vessels is being demonstrated at the new testing ground of the Cramps, says the Philadelphia *Record*. There, at intervals of a few days, conical steel shells are fired through four inches of solid steel armor plate with as apparent ease as though the plates were the flimsiest cardboard. The range is on the Lewis farm, above Wheatsheaf Lane, along the Delaware River. The shells, which are three inches in diameter and ten inches long, are forged from the finest hardened steel and fitted by the Cramps for use in the United States army and navy, and it is to test the quality of the steel in different lots that these experiments are being conducted.

A heavy abutment of railroad ties has been erected as a fender to hold a bank of earth, and in front of that is placed a heavy oak plank box, five feet square and ten feet long, which is filled with sand.

Against another fender in front of this box is set up one of the armor plates, such as are used on the armored cruisers and battleships now being built. One hundred feet distant from the plate is the firing house—a plank building about thirty feet long by ten feet wide, and double lined to deaden sound. Two three-inch rapid-firing Driggs-Schroeder guns are used in the tests. When everything is ready for firing, a lanyard is passed out of the back of the building and through an aperture in a pile of heavy spruce joist, the gun having previously being sighted.

When the gun is fired, the wall of steel is pierced by the projectile, leaving only a fringe around the hole where the shot passed out on the opposite side. It is then sought for in the sand in the box and examined closely as to condition. Of course the shell is not charged, or it would explode and blow up the box and all around after going through the steel. Not all the shells fired at the steel armor plate go through it, and this is considered sufficient cause for condemnation of that batch of projectiles. The experiments are all conducted by the Cramps' regular staff of ordnance officers.

Aluminum.

It is true that every brick in a house and every bank of clay contains a considerable quantity of that beautiful metal aluminum. But science has not yet discovered any economical way of extracting the metal from clay, because in the form it there exists, namely, aluminum oxide, it is combined with silicon oxide, and these two substances behave like a pair of Siamese twins; they are so strongly bound together it is next to impossible to separate them. Therefore, in the production of aluminum, chemists do not use clay, but turn to some material which contains the oxide of alumina free from silica. The best material is a mineral known as cryolite, which comes chiefly from Greenland. It is a double fluoride of aluminum and sodium and an artificially prepared sesquioxide of alumina; these are suspended in a bath of molten chlorides of the alkaline earths and then subjected to electrolysis by powerful dynamos. The sodium salts are decomposed, the metallic sodium seizes eagerly upon the oxygen that was in combination with the aluminum, and as a result the white metal aluminum is freed and settles to the bottom.

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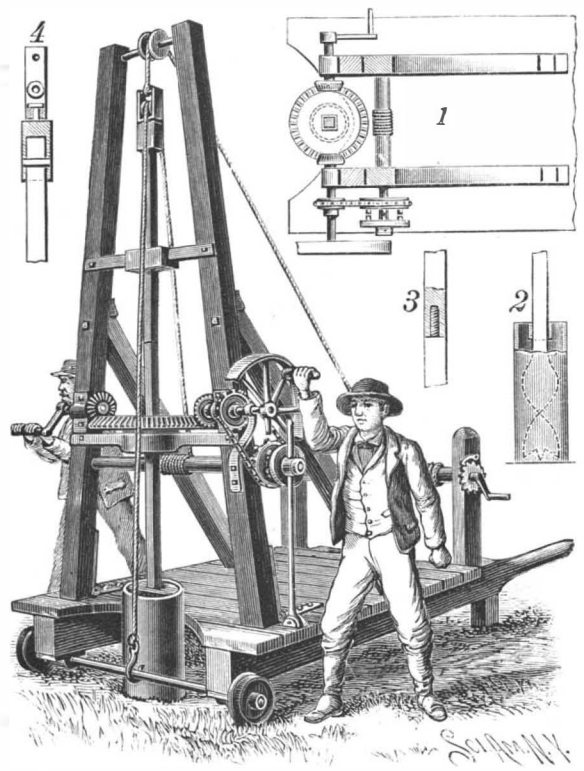
A POST OR POLE HOLE BORING MACHINE.

This machine is mounted on a hand truck, which may be readily shifted about on the ground for conveniently and rapidly boring holes for setting up posts or poles. It is a recently patented invention of Mr. John P. Morris, Charlotte, N. C. Fig. 1 is a sectional plan view illustrating the means of operating the auger shaft, Fig. 2 showing the auger and its inclosing cylinder, Fig. 3 a connection between the auger shaft sections, and Fig. 4 the upper end of the auger shaft. The auger shaft is preferably made in sections screwed together, according to the depth of the hole to be made. The shaft is square and passes through a collar in an upper cross bar of the main standards, while on its lower end a cylinder is mounted to turn and slide, this



MORRIS' POST OR POLE HOLE MACHINE.

cylinder supporting the ground loosened by the auger and also forming a temporary wall for the lining of the hole. On the upper end of the auger shaft is a cap in which turns a block carrying a pulley, over which passes a rope with a hook at one end engaging the truck axle or other fixed support, while the other end of the rope winds on a windlass, whose shaft is journaled in the main standards. A clutch on the latter shaft is adapted to be engaged by a clutch sprocket wheel connected by a sprocket chain with a sprocket wheel on the driving shaft, the bringing of the clutch into engagement with the sprocket wheel rotating the shaft of the windlass and drawing upon the rope to force the auger into the ground. The driving shaft has on its outer end a hand crank, and on its inner end is a beveled gear in mesh with a gear wheel having a square central aperture, through which passes the auger shaft, as shown in Fig. 1, there being also a similar oppositely arranged bevel gear wheel and shaft with crank handle to be turned by a second operator. In this manner, by the turning of the crank handles, a rotary motion is given to the auger and it is at the same time forced downward into the ground. The pulley block on the upper end of the auger shaft is connected with a rope passing over a pulley at the top of the standards and extending to a windlass on the rear of the truck, by operating which the auger shaft and its cylinder, with the loosened earth the latter contains, may at any time be lifted out of the hole and the cylinder emptied. The standards are connected with the truck platform by hinges, and may be folded back upon the truck when the machine is moved from place to place.

The New York Elevated Street Railways.

The elevated railroads of New York City carried 221,000,000 passengers during 1893. Twenty new engines were ordered during the year. The number of passenger coaches employed in the service is 1,116, and 75 new ones were added during the last four months. Improvements in the structure continue to be made, and the light 50 and 60 pound rails are being replaced by 90 pound rails. The locomotives consume over 200,000 tons of the best white ash anthracite per year. The coal makes no smoke. Over 3,000 trains per day are run, the exact number being 3,300. The employes number 5,000, and all are paid by the hour. Twelve hours is the longest time any man is required to work per day on the roads. The maximum pay is $3.50 per day. Engineers earn $100 per month.

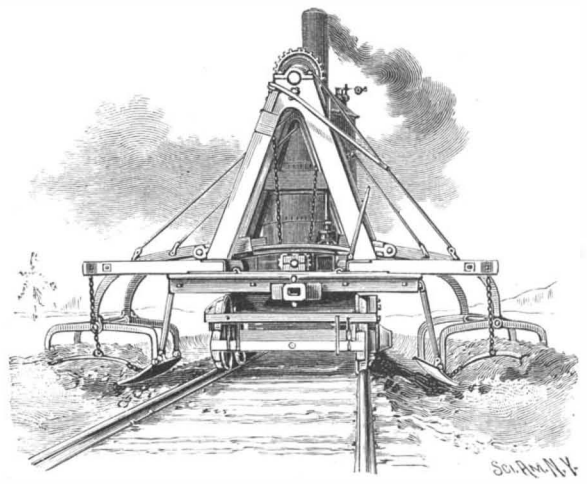
COTTON GINNING MACHINERY AT THE FAIR.

The exhibit of the Eagle Cotton Gin Company, of Bridgewater, Mass., consisted of a battery of gins, and illustrated a complete system of handling cotton from the wagon to the press, the machinery and apparatus embodying all the latest improvements in this line. The company last year celebrated its sixtieth anniversary, the business having been founded in 1833, and during this long period of sixty years its position in the front rank of manufacturers of machinery and appliances for the preparation of cotton for market has been unquestioned. It has always been among the first to introduce and thoroughly test improvements designed to reduce labor and add to the efficiency of the machines, while maintaining their simplicity and durability. Their battery gins economize space, are always under easy control and have self-oiling and self-adjusting boxes. The seed-cotton elevator draws the cotton directly from the wagon or the cotton house and deposits it in receptacle boxes of large capacity, from which it passes into a short horizontal feeder which regulates the quantity to the gins evenly and level. From the start until the close of the bale every gin is doing its full duty. The elevator has a large screen capacity and thus serves as an excellent cleaner for the cotton. The lint conveyer has an incased canvas apron running over large rolls, and is placed back of the condensers which are attached to each gin as in ordinary ginning. Canvas carrier aprons are driven by link-belt chain, and thus are positive in their movements, there being no possibility of clogging, as air pressure is not depended upon for the conveyance of the lint from the condensers to the press. The company has for the past three years manufactured a special long staple hulling and separating gin, which has proved a great success.

Six awards, with medal and diploma, were granted the company, for—1. Apparatus for elevating seed cotton to gin; 2. Eagle Eclipse hulling gin; 3. Cotton gin feeder; 4. Lint cotton conveyer; 5. Cotton gin; 6. Complete system of handling cotton from the wagon to the press.

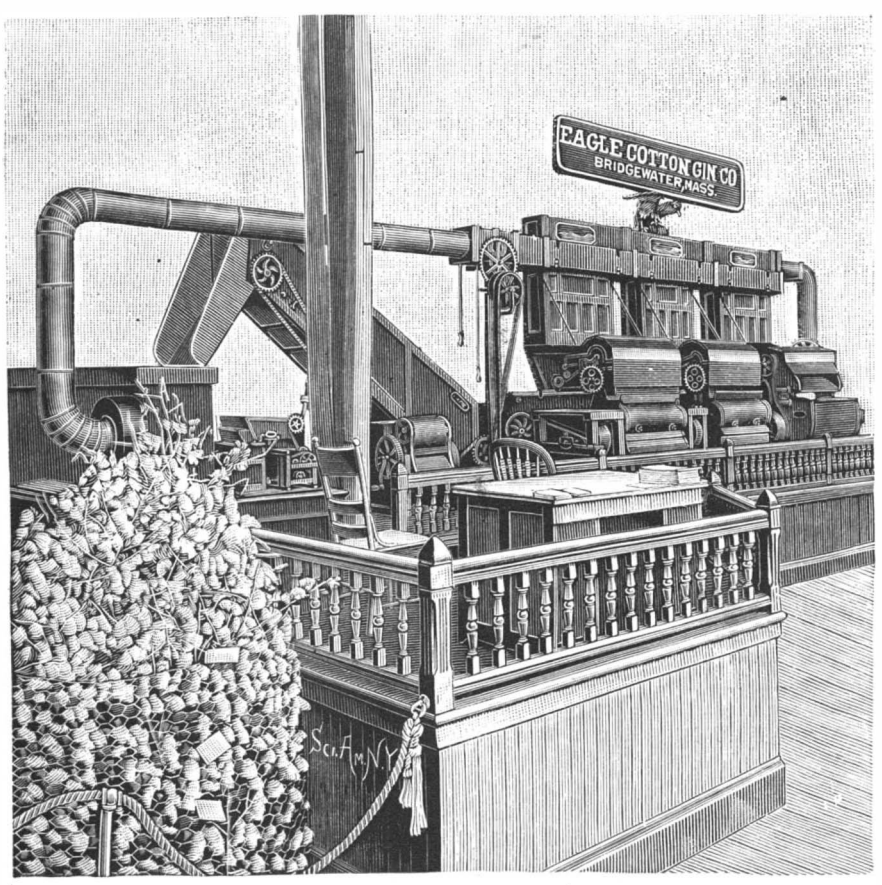
A DITCHING MACHINE FOR RAILWAY SERVICE.

This is a machine adapted to form a ditch on one or both sides of the roadbed of a railway, the ditching mechanism being operated by engines on the rear end of the platform car on which the apparatus is arranged. The improvement has been patented by Mr. William L. Harvey, Stanberry, Mo. The front ends of the sides of each of the scrapers are connected by chains with a draught bar connected with a draught beam



HARVEY'S DITCHING MACHINE.

pivoted on the car, and held in place by a pivoted brace, to permit of swinging the draught beam inward when not in use, the rear ends of the scrapers being also similarly connected to a draught beam. The inner side of each scraper has a pivoted wing, to prevent dirt from falling on the track, and is connected with a link regulating the depth the scraper is to work, while the outer side has a pivoted wing adapted to give the desired slope to the side of the ditch. Each of the scrapers is suspended from a shaft connected with levers pivoted on swivel blocks, sliding transversely in guideways on the car platform, the front and rear levers of each scraper having each a clevis from which a rope extends up to a hoisting drum on a longitudinal shaft journaled in standards. This shaft is actuated by a sprocket chain from the main driving shaft, operated by engines of any approved construction on the rear end of the car. As the car on which the apparatus is arranged is pushed forward by a locomotive, the scrapers dig into the ground until they are full, the car being intermittently moved forward only about the length of the scrapers at a time. The operator then, by means of a clutch mechanism, connects the hoisting drums with the driving shaft, whereby the scrapers are lifted, and the car is drawn by the locomotive to the place of dumping, where the dirt is automatically discharged. After the scrapers are loaded and raised, they may be moved inwardly on the top of the car, to permit of passing through tunnels, over bridges, etc. For the purpose of spreading the dirt at the place of dumping, a special form of spreader is provided for attachment to the machine in place of the scraper.



THE WORLD'S COLUMBIAN EXPOSITION—EXHIBIT OF THE EAGLE COTTON GIN CO., OF BRIDGEWATER, MASS.

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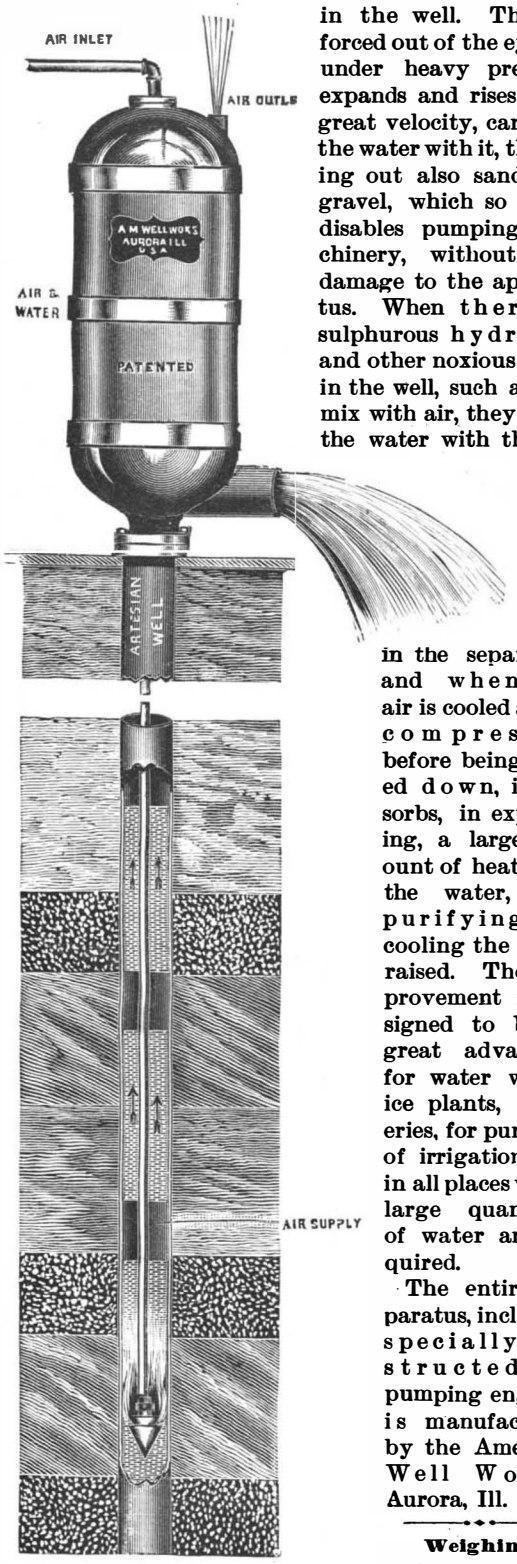
AN AIR-LIFTING PROCESS FOR WELLS.

The illustration represents the practical application of a novel process of causing non-flowing wells to flow without pumping, which is said to have proved eminently successful, and to be more economical than any other means at present employed for raising large quantities of water. The improvement consists in placing centrally in the well an air-pipe, as shown in the engraving, the pipe being connected with an air compressor and a separator at the top, and having at its lower end a peculiarly constructed ejector, the lower end of the pipe being carried down to a predetermined distance below the natural level of the water in the well. The air forced out of the ejector under heavy pressure expands and rises with great velocity, carrying the water with it, throwing out also sand and gravel, which so often disables pumping machinery, without any damage to the apparatus. When there are sulphurous hydrogen and other noxious gases in the well, such as will mix with air, they leave the water with the air in the separator, and when the air is cooled at the compressor, before being forced down, it absorbs, in expanding, a large amount of heat from the water, thus purifying and cooling the water raised. The improvement is designed to be of great advantage for water works, ice plants, breweries, for purposes of irrigation, and in all places where large quantities of water are required.



CHAPMAN'S AIR-LIFT WELL.

The entire apparatus, including specially constructed air-pumping engines, is manufactured by the American Well Works, Aurora, Ill.

Weighing.

The operation of weighing is so familiar to all that many are apt to forget what is actually done when anything is weighed. The method of weighing is adopted as a ready and easy means of finding the mass of a body—that is, the quantity of matter in it. This is done by comparing the attraction of the earth on the body in question with its attraction on another piece of matter whose mass is known. When the masses in the two scale pans of a balance are equal, the mass of the earth attracts them equally, and the beam of the balance stands horizontally; the balance is in equilibrium, and the substances in the two pans are said to be of equal weight. But the attraction of the earth on a mass near its surface depends on the distance of that mass from the center of the earth, so that a pound has less weight at the top of a mountain than in the valley below. The weights of bodies vary according to their position on the earth's surface, and the same mass has a greater weight at the poles than at the equator, because in the former place it is nearer to the center of the earth, and the earth's attraction for bodies outside it is the same as if the whole mass of the earth were concentrated at its center.

Again, at the equator, the motion of the earth about its axis tends to cause a body to fly away from the axis and to decrease the weight of the body. Thus the weight of a body, far from being a constant quantity, varies as the body is moved from place to place. Nevertheless, the method of weighing is an accurate way of determining the amount of matter in a given body, because by this operation we simply compare two attractions, and the forces of attraction on the body and on the standard weights with which it is compared vary equally as the balance is moved from one position to another; thus, although a body is lighter at the equator, so also is the standard pound against which we compare it.

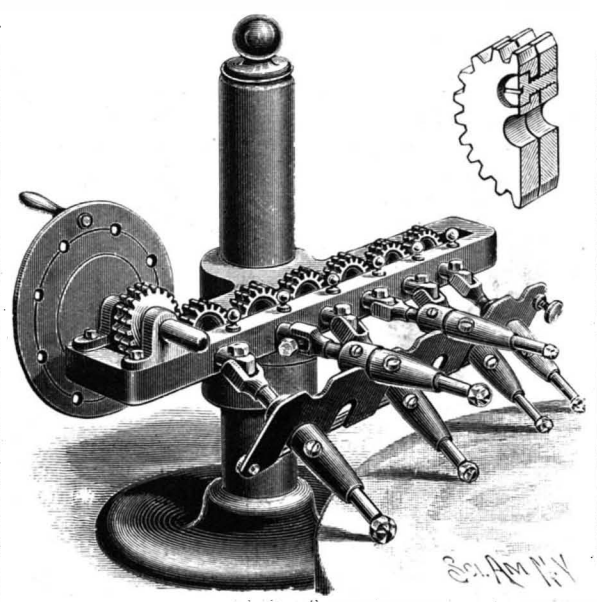
The comparison of weights is simple and familiar enough, but can we weigh the earth itself or find its mass? What can we compare it with? Here, again, what is to be done is to compare two attractions. If we can find the attraction of some mass—a part of the earth—on another mass, and then compare this attraction with that of the earth on the same mass—that is, with its weight—the problem is solved.—*Knowledge.*

Patents and Population.

The following facts are significant: Mississippi takes one patent for every 20,469 of her population; Connecticut, one for every 1,018 of hers; South Carolina, one for every 23,490; Massachusetts, one for 1,055; North Carolina, one for every 21,288; Rhode Island, one for 1,191; Georgia takes one for every 14,817, and New York one for 1,635. Alabama takes one for every 18,457, Illinois one for 1,944.—*University Quarterly.*

A WORK HOLDER FOR GRINDING MACHINES.

This is a device for holding precious stones on the abrading face of the lap or other grinding wheel, facilitating the grinding of a number of stones of various sizes at the same time. The improvement has been patented by Mr. William Linden, of Helena, Montana. Upon a post having a suitable base to give steadiness a collar is adjustably held at the desired height by means of a set screw, and on top of the collar loosely rests a hub forming part of a horizontally extending frame forming bearings for a series of short shafts. The outer ends of the shafts are connected by universal joints with drops adapted to support the work at their outer lower ends. Each drop has at its outer end a short rod, on the extremity of which is cemented or otherwise fastened the stone to be ground, the rod being adjustably held by a set screw in a sleeve, while the other end of the sleeve is adjustably held on a rod carrying part of the universal joint connecting the drop with one of the short shafts, whereby the holder can be lengthened or shortened according to the size of the stone. On the inner ends of the short shafts are segmental gear wheels, as shown in the small figure, in mesh with one another, an end wheel being in mesh with a driving gear wheel turned by a handle, and adapted to be locked in place by a pin passing through one of several apertures in an indicator wheel and into an aperture in the frame. As shown, there are eight apertures in the indicator wheel, and when one facet is ground by the revolving of the lap, the moving of the indicator wheel to the next registering aperture causes a corresponding rotation of the short shafts through the gear wheels, giving all the drops a like turn, so that a new surface is presented to the abrading surface of the lap. The several drops are engaged by a guide, preferably made of light sheet metal, having on one side recesses engaging annular grooves in the sleeves, and a pivoted locking arm extending over the entrance openings of the recesses. While grinding the facets the operator, by moving the guide, brings the work continuously on different places on the abrading face of the lap, insuring uniform grinding, and in case one facet is finished before the others, the locking arm is opened and the drop holding this facet is swung upward, carrying the work out of engagement with the lap. The segmental gear wheels on the short shafts are each made in two parts, as shown, to take up lost motion caused by wear or other reasons, the parts being connected by a set screw whose head and part of the shank passes loosely through a slot in one section, admitting of the setting of the two sections to bring the teeth out of alignment.



LINDEN'S WORK HOLDER FOR GRINDING MACHINES.

SOME ANCIENT REACTION ENGINES.

BY W. F. DURFEE.

There seem to have been several recent attempts, said to have been fairly successful, to apply modern science to the perfecting of the oldest known form of steam engine, that described in the "Spiritalia" of Hero of Alexandria, which was written about B. C. 150. Of the real antiquity of the machinery described in this work we have no certain knowledge, for Hero in his preface says he has "thought proper to arrange in order what has been handed down by former writers, and to add thereto our own discoveries;" but unfortunately he nowhere designates either his own or the more ancient inventions; hence the reaction engine may be among the mechanisms that were old even in Hero's time.

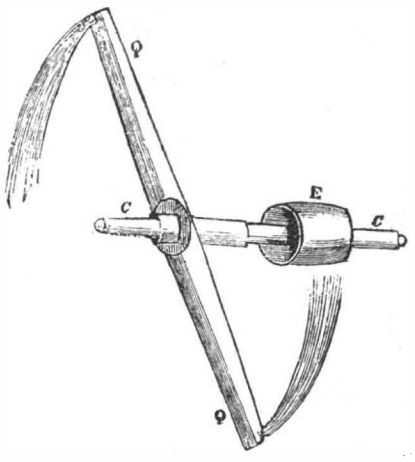


Fig. 2.—AVERY'S ROTARY ENGINE.

The reaction engine is the simplest form of mechanism yet suggested for utilizing the power of heat in the form of steam, and it will be a remarkable reversion if, after a couple of centuries of heterogeneous and ponderous complexity of design in steam machinery, we should return to the simple ideas of 2,000 years ago.

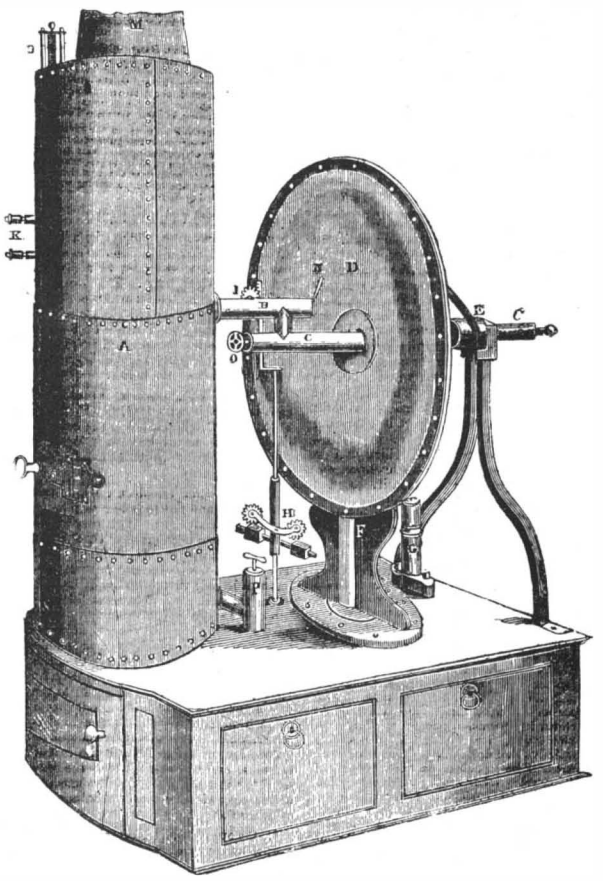


Fig. 1.—AVERY'S ROTARY ENGINE.

Since steam began to be employed as a motive power for manufacturing purposes, there have been several efforts to introduce engines for its use more or less like that described by Hero, and in view of the present tendency toward a careful study of the utilization of steam in reaction engines, it may not be untimely to recall some of the particulars of a reaction engine which was manufactured and used to some extent in this country sixty years ago.

The illustrations and description are taken from Vol. 24 (No. 637, October 24, 1835) of the *Mechanic's Magazine* (English). Its editor says:

AVERY'S ROTARY ENGINE.

"We have quoted at different times from the American journals some very favorable notices of a rotary steam engine invented by a Mr. Avery, which had been introduced into two or three manufactories, where it had given great satisfaction, and been applied in one instance with success to a railway carriage. Mr. Minor, of Wall Street, New York, has had a small engine on this principle built for his printing office, and in a recent number of his excellent *Railroad Journal* there is the following account of its construction and performances." Ed. *M. M.*

In No. 12, Vol. 4, of the *Railroad Journal* is pub-

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lished an account of the performance of one of Mr. Avery's engines used by the proprietors, Messrs. Lynds & Son, in their shop at Syracuse, New York, which has now been in use more than two years, and we cannot do better than republish a part of that article. The following extract refers to an engine with 18 inch arms of 6 horse power, but the engraving given herewith represents one with 12 inch arms, or about 2 horse power. There is one now in operation in this city for sawing mahogany, with 2½ feet arms, which will do the work of a 12 or 15 horse power engine, and performs to the entire satisfaction of those who use it.

The engine, that is the shaft and arms, weigh, as I learn, only 15 pounds; the arms, from center of shaft to their ends, are 18 inches, and in their revolutions describe a circle of 9 feet 5 inches in circumference; the two apertures at the end of the arms are equal to the eighth part of a superficial inch, and under a pressure of 80 pounds to the square inch will balance a weight of 10 pounds. From some experiments made it is estimated to carry a load of 8 pounds through a space of 37,660 feet per minute. The boiler has 66 feet surface exposed to the fire, and consumes daily half a load of soft dry wood. There are in the establishment the following machines in operation, namely: two large engine lathes, one boring mill for boring cylinders, two drilling lathes, one grindstone, one mill for grinding coal, two bellows of 40 double strokes each per minute, which will force, under a pressure of 1½ pounds per square inch, 580 cubic feet of air per minute, and requires 4 to 5 horse power to perform its operation of melting 1,500 pounds of iron per hour.

The following explanation will give an idea of the engine put up at our office:

The prefixed engraving (Fig. 1) is an elevation of a two horse power engine, built to drive a printing machine, which prints both sides of the sheet before it leaves the press. This engine, together with the boiler, force pump, and governor, and, in short, everything necessary for communicating motion to steam, and to the machinery to be operated upon, occupies a very small space, it being only 4 feet 8 inches by 2 feet 10 inches.

A is the boiler, 17 inches in diameter and 78 inches high, standing in a cast iron frame, with a grate inside.

B is the steam pipe, which conducts the steam to the end of the shaft, C C, one end of which is inclosed in a (superfluous) cast iron tube. The steam is ordinarily conducted from the boiler to the end of the shaft in a simple steam pipe, which may be 6 inches or 6 or 12 feet in length, to accommodate the engine to the machinery, without regard to the position of the boiler.

C C, the shaft, passing through the case, D, and the arms, Q Q (Fig. 2), which are inclosed and revolve in the case, D. On this shaft, as will be seen in Fig. 2, is the pulley, E, from which the band passes to the machinery.

D is a circular cast iron case, in two parts, fitted and put together with bolts and made steam tight. This case has in some instances been made of sheet iron; cast iron, however, is deemed best. The case, although the engine or revolving arm is only three-eighths of an inch in the thickest part, is at least 5 inches through in the center where the shaft passes, having the two concave surfaces turned; and it is considerably larger, or of greater diameter, than the length of the arms, that there may be space, which is enlarged by giving to the casting, near the outer edge, a half circle in each part of about 3 inches in diameter, which forms a circular channel or groove for the steam beyond the end of the arm, and by which it finds the outlet, F, through the bottom, and connected with a pipe which conducts it off outside of the building.

G, the supply pump, operated in this engine by cogwheels, but ordinarily by a band. The wheels, however, are not represented in the engraving, being desirous to show the engine as in general use and in its simplest form.

H I, the governor, or apparatus for regulating the supply of steam to the engine. This regulator is constructed upon a new plan, and works with cogwheels.

K, gauge backs.

L, safety valve, is set at 100 lb. to the square inch.

M, smoke pipe—a six inch stove pipe.

N, apparatus for stopping the steam or letting it on to the engine.

O serves to regulate the packing around the shaft.

P, the supply water pipe.

Fig. 2, C C is the shaft; E, pulley for the band; *r*, the orifice in the end of the shaft where the steam enters; Q Q, the arms at right angles to the shaft, and through which it passes.

There being a free communication (except when obstructed by the throttle valve, G, which may be in part or entirely cut off, as may be desired, thereby increasing or diminishing the velocity) from the boiler to the shaft and arms, there is necessarily an equal pressure upon the square inch of the arms as upon the boiler; and hence the *reaction*, in consequence of the pressure in every part, except where the steam escapes, and not from the action of the steam against the atmosphere, as is generally supposed.

The principal advantages of this engine, as we conceive, consist in its compactness, the ease with which it is managed by any person who can tend the fire, the trifling cost of fuel as well as the small outlay for the engine. The most important advantage, however, for many purposes, and especially for driving printing machines, will be found in its perfectly uniform motion. It is indeed so perfect, and the velocity so great, being about 5,000 revolutions of the arm shaft, and of course pulley or wheel, the band runs per minute, that but for other than the ordinary machinery attached to the engine a casual observer would scarcely know that a steam engine was in operation.

This engine, we are yet full in the faith to believe, will be found an important improvement for railroad purposes. The only locomotive of the kind ever used ran for a short time last spring on the Newark Railroad; and after various experiments which were made to test its qualities and power, a car was loaded with four tons of iron, and attached to the engine, which took it with great ease over the Bergen ridge, where there is an elevation of 152 feet to the mile, and in one place for a *short* distance, when leaving the direct track for that built temporarily on the bank, of 6 feet in 100, or 312 feet to the mile.

Another account states that the engine ran "4½ to 5 miles in eleven minutes."

Whatever the merits of this engine may have been, we do not think the writer in the *Railroad Journal* of threescore years ago is deserving of much commendation for perspicuity in his description of them. However, machinery was not very common at that time, and facility in describing it was not to be expected. At the beginning of the century there were but three steam engines in the United States; one an imported engine put up in 1763 (by a son of the Hornblower who had the legal contest with Bolton and Watt) at the Schuyler copper mine, in New Jersey; one at a sawmill in New York City, and a third in Philadelphia, used by Oliver Evans for grinding plaster.

The enormous increase of steam power since the beginning of the century is at the same time a measure of, and a most prominent reason for, the wonderful development of the United States during the past hundred years. In the belief that a knowledge of the total horse power of the engines now in use in this country would be of interest, and that the statistics of the increase for each decade would be startling in their immensity, I applied to the Census Bureau for information relative thereto, but was very much surprised to learn that the statistics of steam power had not been collected.

[FROM THE NEW YORK SUN.]

Photography and its Rights.

A lawsuit of some significance has been begun by the Chicago Fair people against two St. Louis firms for publishing photographs and process reproductions from photographs which are the property of the first named. Of course no one can maintain exclusive property in a view, but equally one can maintain property in any individual photographic negative. One can possess such property in a view from a dwelling site as to recover damages for its obstruction in certain cases. But different photographs of any given view, as well as prints made from those photographs, may be very good or very bad. Products of the operator's skill in getting good views are obviously as much a subject of property right as any other product of skill.

The photographic camera is fast coming to be considered part of the equipment of the geologist. It is already an essential in the preparation of medical treatises. It is of habitual use in the preparation of trade catalogues. It would be difficult to name the science or the art that now makes no use of photography. It is a powerful nstrument in the hands of criminal justice. It is a part of the platform lecturer's equipment. While science and mechanic art recognize photography at its professional value, fine art adopts it as a handmaid and law enlists its service. It has thus come to acquire a status whose recognition is requiring an increased precision of definition.

The processes of photo-mechanical printing in colors broaden the base on which the principles of such definition must repose. There is no question here of patented process, but of the results of process without any reference to specifications of that order. There have recently been produced fine specimens of chromocollographic printing representing the covers of old books in the British Museum. The general results are described as being so rich and truthful as to convey no idea that they are produced in so simple a manner. Where the cover of a book is torn or frayed, for example, the reproduction is remarkably natural. Now, while those books can be copied by others under the general regulations of the Museum, which do not respect persons, it is not deniable that the particular reproductions here described are and of right ought to be a property vested in the skillful operators who produced them.

Some landscape photographs taken by the same process are described in the same number of the *Camera Club Journal* and pronounced exceedingly fine. A notable feature in these is the sky. Now, really good sky and cloud photographs are hard to get, and may be especially valuable, as say in the study of clouds. While no man may own the sky, is it not obvious that the value subsisting in these products of a special skill is the rightful property in the individual displaying it? And, again, practical photographers know how large a part is played by luck in hitting the supreme conditions of light and shade for a given view, as well as in fixing them when hit. There is the same propriety in securing to the operator this fortuitous value as in allowing a property in the finder of a precious stone.

A decision was rendered at Paris recently awarding damages against two American white metal companies for pirating certain statuettes, the original models of which were owned by the plaintiffs. There is a difference in principle between pirating the fruits of a man's skill in one line of art and of his skill in another line. For in photography the matter dealt with is not intangible; it is not an idea—it is a concrete product. When appropriated by another it is appropriated for gain, as any other article of production is stolen by any other thief. The character of the act is not changed by statutory definitions, though the penalty or the remedy for injury may be. In either case the failure to punish or to compensate is a failure either of public or private justice.

Fortunately for the chances of procuring the rule of right in cases of photography to become also the rule of law, the photograph is a concrete thing which is not the product of imagination. It is produced from start to finish by the use of mechanical apparatus, operated upon external material substance in the same sense that a saw blade is produced. The negative is not like the die of a medal, into whose execution the creative quality of design has entered. Nature created the photograph's design. The operator has done no more than apply human skill, of a kind not different in kind from that which tempers and sets the saw blade, to produce an individual reproduction of that design. This reproduction is identifiable from all others. Its utility inheres in the copies made from it, which can proceed from no source other than this particular negative. And whithersoever the individual picture, itself a mechanical product, can be identified, there its original producer ought to be able to follow the property he created and to enjoy its beneficial use.

The essence of property right is the beneficial use of its subject matter. To protect the property right in a photographic negative is, then, to protect the right of making copies. To steal the negative itself is an act of allowed larceny. But, apart from making copies, no other kind of value attaches to the blurred sheet of glass. Apart from this right, it is a messy window pane. Has the negative, then, no quality of value but as a window pane? Its film is a part of itself, and as such is allowed property. This film has had a particular quality impressed upon it by the operator's skill, which quality is individual. It has become something more than the material of a film, and something different from all other films. By no process of sound reason, by no analogy from other things, can the photographer's rightful property in his own work be grounded on statutes of patent or copyright. The first may apply to his process as an inventor. The second can never, but by confusion of thought, be deemed essential to his title to the work of his hands.

Allowing this, the protection of that title cannot rightfully be abridged through any defect of statutory enactments on which it cannot rightfully be held to depend. It is the natural title inhering in the laborer to the work of his hands, which statute might conceivably take away by expropriation for the public use or a principle similar to that which has led governments to buy works of art or valuable discoveries or inventions for common benefit. No other mode of depriving this particular workman, the photographer, of the fruit of his labor can be distinguished in principle from robbery, taking the word in its literal intent.

At Sea on an Ice Floe.

Recently the lifeboat society at Cronstadt received news that toward the south shore of the Gulf of Finland, about 30 miles from Cronstadt, some 200 fishermen and peasants, with their horses and sleighs, had been suddenly carried out to sea on a large ice floe, which had been detached apparently by a recent storm. The ice-cutting boats at Cronstadt were laid up for the winter, and could not be used. Twenty sailors, however, with two officers and assistant surgeons, were dispatched over the ice with two lifeboats on runners, and a similar party started to the rescue from Oranienbaum, on the other side of the mouth of the Neva. The latest telegrams from Cronstadt state that the fishermen and others have been found and all rescued by means of a bridge made of poles and planks, which was thrown out from the firm ice. They had been cut off from the mainland for at least 48 hours, during the latter part of which provisions were passed over to them by the inhabitants of the nearest shore.

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Action of the Electric Arc on the Diamond.

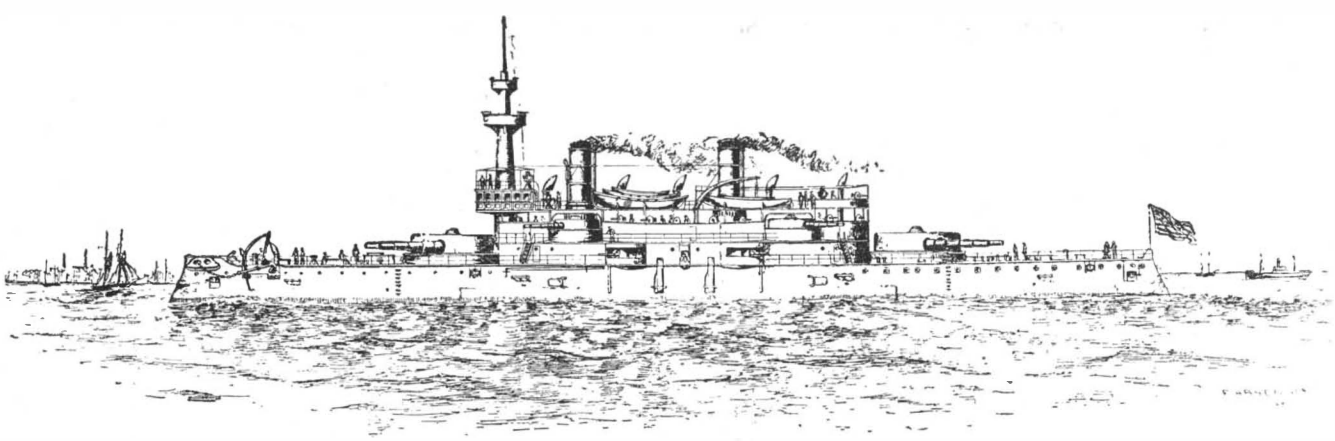
M. H. Moissan, in the *Compt. Rend.*, deals with the action of the electric arc on the diamond, amorphous boron, and crystallized silicon. In the electric arc, at a somewhat high temperature, the diamond becomes incandescent, swells up without melting, and becomes covered with black masses consisting entirely of hexagonal lamellæ of graphite, which is easily converted into graphitic oxide. If the diamond is placed in a small carbon crucible in the electric furnace previously described, and is subjected to the action of an arc produced by a current of 70 volts and 400 amperes, the crystal first breaks up into small fragments along the planes of cleavage, and then at higher temperature swells up and is completely converted into graphite, which yields yellow graphitic oxide. It follows that at the temperature of even a moderately intense electric arc, the stable form of carbon is graphite. When heated in a carbon envelope at the temperature of the oxy-hydrogen blowpipe, the diamond is covered with an adherent black mass, which slowly dissolves in a mixture of potassium chlorate and nitric acid, but which is not graphite. Amorphous boron, prepared by means of magnesium, volatilizes without fusion in the electric arc, the extremities of the electrodes being converted into partially crystallized boron carbide. Crystallized silicon, when heated in the arc, first melts and then boils, the extremities of the electrodes at the end of the experiment being covered with pale green crystals of carbon silicide. The phenomena in the arc were observed by projecting on a screen by means of an intense arc an image of the arc of lower intensity in which the substances were heated.

THE NEW BATTLE SHIP INDIANA.

The latest and the most formidable thus far of our new warships had her preliminary trial on March 7. The course was off Cape May, where she was practically under five hours' continuous steaming at high speed, everything working smoothly. The first runs were made with natural draught, and the speed averages were 14·02 and 14·12 knots; then a moderate forced draught was used, bringing the speed to 15 knots, which is that called for by the government contract. Two trials were then made with the full forced draught, bringing the speed to 15·6 knots, a result considered highly satisfactory by the builders. From the results obtained on this trial it is predicted that the ship will make sixteen knots or more on her official trial. A premium of $25,000 is paid by the government for every quarter knot attained over fifteen knots.

The Indiana was built by the Messrs. Cramp, of Philadelphia, and the contract price was $3,020,000, exclusive of armament. She was launched February 25, 1893. She is designed to meet in battle the best modern war ships, carrying the heaviest guns and armor. She is built entirely of steel, with a length between perpendiculars of 348 feet; extreme breadth, 69¼ feet; mean draught, 24 feet; displacement, 10,281 tons. Her hull has numerous watertight compartments, and the armor protection consists of a heavy belt of Harveyized nickel-steel armor, 18 inches thick, extending along the water line. Rising from each end of this will be an armored redoubt, 17 inches thick, extending to a height of 3½ feet above the main deck. Within the redoubts will be two 18 inch turrets (one in each), containing the heaviest guns. There will also be other armor elsewhere on the ship of less thickness.

The powerful armament, however, is the feature of the ship, it being the most efficient afloat. It will consist of four 13 inch breech-loading rifles, mounted in pairs in the two turrets referred to; eight 8 inch breech-loading rifles, in four turrets, placed at each corner of the superstructure; four 6 inch breech-loading rifles and a secondary battery of sixteen 6 pounder and four 1 pounder rapid fire guns and four Gatlings. There will be also six torpedo tubes. The vessel is cut up forward beneath the water line, making a powerful ram bow, doing away with excessive bow waves on account of easier lines so obtained, as well as greatly adding to her maneuvering qualities.



THE NEW BATTLE SHIP INDIANA.

Saccharin.

Saccharin is regarded by a French writer (*London Lancet*) as a valuable antiseptic. A strength of 1 to 500, as an addition to mucilaginous and other solutions, prevents the formation of low organisms. Thus a valuable, inexpensive dentifrice may be prepared by simply dissolving saccharin in water, to the proportion of 6 per cent. A teaspoonful of this in a half pint of water forms an admirable antiseptic mouth wash. In cases of malignant or other diseases of the stomach, requiring the washing out of that organ, a solution of saccharin of the strength of 2 per cent will be found very suitable.

EMIL GREINER'S AUTOMATIC PIPETTE.

The ordinary chemist's pipette is a troublesome apparatus to manipulate. It is filled by absorption with the mouth, and its contents, of course a fixed quantity in all cases, are determined by the liquid standing exactly at the level of the marks surrounding its upper stem. In filling a small surplus is invariably drawn into it and by closing the top with the finger it will be kept full. By admitting air at the top, the liquid is suffered to descend until the mark on the upper stem is reached, when it is ready for delivery. It is quite difficult to reach the upper mark exactly. As ordinarily used by mouth absorption, there is always more or less danger of the liquid being drawn into the mouth, which in the case of sulphuric acid, or ammonia and similar chemicals, is a source of absolute danger.

The cut illustrates an automatic pipette, due to Emil Greiner, of this city, which, in its construction, does away, not only with all danger in its use, but which makes the measuring of the liquid instantly effected by the filling operation. The upper stem of an ordinary pipette terminates in a contracted nozzle somewhat bent over; from this upper nozzle to the lower one it holds the exact quantity for which it is marked. A second glass bulb fastened airtight to the upper stem of the pipette is fitted with an India rubber bulb at its upper extremity. To use it the bulb is squeezed, the lower end of the pipette is placed in the liquid and the bulb released from pressure. As it expands the liquid rises in the pipette until it overflows from the upper end. When the bulb has fully expanded the overflow ceases, and on removal from the liquid the pipette is accurately filled. Its contents can then be delivered as desired by squeezing the rubber bulb. A certain amount of overflow collects in the upper glass bulb, which is removed by pulling off the upper bulb and emptying it from the upper end. For chemists, especially in operations of the silver volumetric assay, in the mixing of standard solutions, its applicability is obvious. For the photographer it is admirably adapted, supplying him with an accutate measure of volume, instead of the grossly inaccurate graduate so generally used.

Aluminum Bronze.

At the recent meeting of the American Society of Mechanical Engineers, Dr. Leonard Waldo presented to the members some specimens of what is called "aluminum bronze," by which is meant an alloy composed of nearly 10 parts of aluminum to nearly 90 parts copper. This, it was stated, was an alloy which could not be separated into its constituent metals again by any ordinary process, had 90,000 pounds tensile strength, with 15 per cent elongation, would cast, forge, roll hot and cold, draw into wire, work in the lathe about as well as steel did, took a high polish, and did not readily tarnish. He pointed out that the difficulties in making most large castings had been substantially overcome, and that the bronze was particularly available for castings to replace complicated steel forgings for steel tooled work where the labor was large. The bronze was stronger than the steel. "It was a mistake," the speaker said, "to classify the alloy of aluminum and copper among the bronzes. Such evidences as we possessed seem to show that a chemical reaction took place when aluminum was added to copper, and that the new compound was soluble in molten copper. There were reasons for thinking that the maximum effect of strength and ductility combined was obtained with an alloy of 10 per cent, and in order to distinguish this alloy from the other alloys containing a less amount of aluminum, it was proposed to call aluminum bronze having 5 per cent of aluminum, or one-half the amount of the standard bronze alloy, half aluminum bronze, and so also a bronze containing one-quarter of the amount of the standard, one-quarter aluminum bronze."

These grades have very markedly different qualities, the grades containing but little aluminum possessing the higher ducility and less rigidity. They all possess a greater resistance to corrosive influence than any other commercial copper alloys.

Spoons were shown made of an alloy containing about 5 per cent of aluminum, and called "half aluminum bronze," these appearing much like solid gold, and, in fact, being passed as such in some instances by jewelers. He expressed the belief that this bronze would prove to be exceedingly valuable in machine construction, especially in view of the possible cheapness of the metals of which it is composed, it having been shown, for instance, that copper could be laid down in New York at a cost of 6¾ cents per pound and that aluminum could be made at a cost of 28 cents per pound.

The Manufacture of Slag Bricks.

The manufacture of bricks from blast furnace slag has attained considerable dimensions in Germany, the Luhrmann furnaces, near Osnabruck, alone having turned out 5,100,000 bricks. The manufacture has also been taken up by other iron works. The granulation of the slag, the first essential portion of the process, which is substantially the same everywhere, is effected by running the slag along a channel together with a stream of water into a reservoir, in which it is collected. The lime to be mixed with it, in the proportion of one part to six of granulated slag, is slaked with sufficient water to yield a moist sludge, and the two ingredients are thoroughly incorporated in a mill, which process is conducted in the following way: The mixed slag and lime are conveyed by a spout, to which a shaking movement is communicated, to a pair of rolls, which stop the access of unduly large fragments of slag or foreign bodies to the mixer proper, and mingle the slag and lime still more thoroughly while reducing them somewhat in size. The final mixing is effected by a set of three drums with radial projections fitting into each other with only a slight amount of clearance, so that the ingredients are brought into the most intimate contact. A machine absorbing two to three horse power will serve to prepare the material for 9,000 to 10,000 bricks per shift of 10 hours. The mixture is moulded into bricks by a machine, which is provided with a hopper kept filled by the laborer in charge, and an arrangement whereby the quantity necessary to form one brick is let down into the mould and then the aperture closed, while the movable sides of the mould are brought into position by eccentrics, and by this means pressure is exerted upon the mass to shape and consolidate it. The finished brick is pushed out of the machine and the operations of filling the mould and applying pressure are repeated. A machine absorbing seven to eight horse power will turn out at least 9,000 to 10,000 bricks per shift, its capacity being limited chiefly by the time consumed in removing the finished bricks. The bricks thus prepared are weak at first, and have to be handed carefully, and must be stacked and protected from rain for the first day, a precaution that is not afterward necessary. They become sufficiently strong for use for building purposes after the lapse of six to twelve months.

Australian Eggs.

Eggs are now shipped from Australia to England. A trial shipment, made by the Hon. J. H. Conner, of Victorian eggs and cheese, was lately inspected by an officer from the department of the Agent-General for Victoria. With regard to the packing of the eggs, they had, in the first place, been rubbed over with grease and afterward placed with bran, flour, lime, and pollard in small cases. When opened they were found to be perfectly fresh and sweet. The cheeses, which consisted of both 40 pounds and "small loaf" sizes, were sound and of good flavor.

THE largest monolith ever cut in this country was quarried of granite in Missouri and transported to the East on a specially prepared train.

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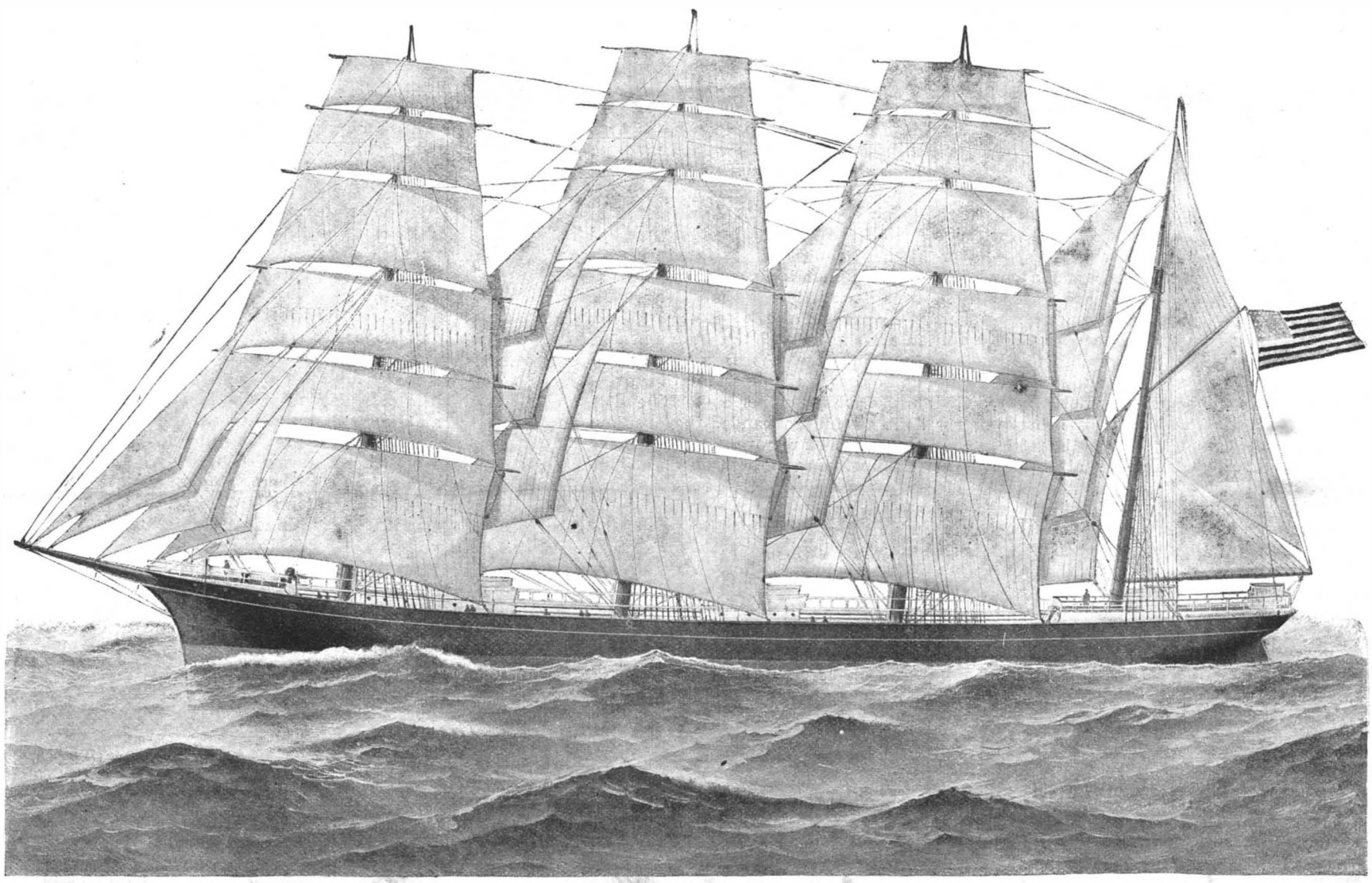
THE DIRIGO—THE FIRST AMERICAN STEEL SAILING SHIP.

At the yard of Arthur Sewell & Co., Bath, Maine, the first steel sailing ship built in America was launched on Feb. 17, 1894. Dimensions: Length over all, 330 ft.; length between perpendiculars, 310 ft.; beam, 45 ft.; depth, 27 ft. 3 in. Designed to carry 4,500 tons dead weight on 22 ft. 6 in. draught and to stand without ballast when light in port. She has a flush main deck of steel fore and aft, the whole of which is sheathed with 3¾ in. hard planking. The lower deck has stringers and tie plates, and is planked with 2 in. hard pine. There are two steel commodious deck houses, the forward and larger one of which contains comfortable quarters for the crew, also galley, and the donkey engine which works the windlass and dumps by messenger chains. The smaller deck house aft is fitted up for the accommodation of all the apprentices and petty officers, also containing the carpenter's shop. There is a large full poop aft, in which is the captain's accommodation, and a nicely furnished saloon 16 ft. square, on the starboard side. The mess room and pantry is in the center, while the officers' cabin and two spare staterooms are fitted on the port side. The vessel is to be steered by the Waddington screw steering gear, the wheelsman being protected by a steel hood open on the forward end. A large flying bridge is fitted, connecting the poop and topgallant forecastle, and this will undoubtedly prove a great convenience in bad weather. The vessel is rigged as a four-masted ship, being square rigged on three masts, the lower masts and top masts all being in one length. The pole bowsprit 67 ft. long, the lower yards 92 ft. long, and the upper and lower topsail yards are all of steel. She will carry single topgallant sails. Has sky sails on the three masts and will spread about 13,000 yards of canvas. In the early spring she will be fitted for sea and will load at pier 19 East River, New York, for San Francisco, Cal. The Dirigo is owned by her builders.



THE AMERICAN-BUILT STEEL SHIP DIRIGO.

Cheap Tooth Brushes and Tooth Picks.

Cheap tooth brushes are responsible for many obscure throat, stomach, and intestinal ailments. The bristles are only glued on, and come off by the half dozen when wet and brought in contact with the teeth. But recently an operation for appendicitis upon a patient at Albany, N. Y., revealed the fact that the trouble was due to the presence of tooth brush bristles. The market is flooded with these cheap goods and the unwary customer buys them because they are cheap and he has not been taught the difference between the construction of poor and good, or the danger that lurks in the shedded bristle. We, as teachers of the public, should never miss an opportunity to recommend reliable makes of tooth brushes, nor fail to point out the dangers of the poorly constructed article. A recent case in practice illustrates other undesirable results from loose bristles. A patient presented, complaining of very sore tooth and much pain about it. Examination revealed undecayed superior bicuspid, sore to the touch, somewhat loosened, and a high state of inflammation and some swelling in the surrounding gum tissue. In exploring the open pocket in the gum about the neck of the tooth, a tooth brush bristle was dislodged. The case was treated, the periosteal and gingival inflammation gradually subsided and the tissues returned to their normal condition.

Probably every observing dentist has noticed this same trouble induced by splinters of wooden toothpicks, minute pieces of rubber dam, etc. In regard to toothpicks, the wooden pick is an abomination, but again its presence prevails on account of its cheapness. The gold toothpick is "a thing of beauty," but not always "a joy forever," as its continuous use is liable to prepare the teeth for a visit to the dentist. A good quill pick is the best pick, and every dentist should impress this upon the mind of the patient. A little advice of this kind is not only beneficial to the patient, but in various ways to the dentist himself.—*Editor, Ohio.*

Influenza is Spread by Contagion.

In a recent paper in the *Lancet*, London, Dr. F. Clemow, of St. Petersburg, presents a mass of evidence showing the highly contagious nature of influenza. The concluding portion is as follows:

One of the most interesting instances was furnished by the town of Prjevalsk, in Central Asia, where the postmaster was the first to sicken, but whether the infection was conveyed by means of letters or (more probably) was contracted by him while traveling is not quite clear. Dr Smolitchef wrote: "On January 4, 1890, after the sorting of the post, the postmaster sickened; he had returned two days before from a tour of his district, in which he had inspected all the post stations, among them one at a considerable distance from Prjevalsk, and where a disease very like grippe prevailed. I was summoned to attend the postmaster," wrote the senior physician to the local lazaret, "and on the next day I began to feel ill; on the third day I had severe rigors, repeated several times, headache, catarrh, cough, etc.; but as there was no time to lie up, in consequence of the extreme scarcity of doctors and the great amount of work to be done, I continued my visits to the lazaret. Every day the out patients were first seen by me, and these must have caught the infection from me and carried it to and spread it among the men of the garrison. It was a remarkable fact that all the acquaintances with whom I had occasion to converse on January 8 and 9 were also seized with grippe, although of a very light character. These facts, and also the circumstance that after influenza patients were admitted to the lazaret all the patients already lying there were quickly attacked with the disease, point to the infectiousness of the air expired by those sick with influenza."

In Viernoe, also in Central Asia, "the officials in the post office were the first to suffer; then on December 18 a Cossack sickened. The Cossack was sent to the regimental hospital, where he remained for two days, and then was discharged. Two days later (December 20) eight men of the Second Sotnia (a sotnia of Cossacks is a division consisting of 100 men) suddenly sickened. It must be noted that the sotnia was quartered close to the hospital and that there was constant communication between the two buildings. Three days later cases of grippe appeared in the military school and in the band." A second reply from the same town confirms this order of events, and the writer adds that influenza was confined to the postal officials for a space of three days. Finally, a third authority in Viernoe, the surgeon to the artillery brigade, wrote that the first cases in the brigade were among men who were sent to fetch the letters from the post. These instances seem to point clearly to the possibility of the infection being carried by means of letters or parcels.

Numberless other examples are to be found in the Russian literature of the subject pointing to the spread of influenza by contagion. I would briefly repeat, in conclusion, that: (1) Influenza is constantly present in many parts of Russia; (2) it began to prevail in epidemic form in or near the Kirghiz Steppes in the autumn of 1889; (3) the cause of its becoming epidemic is not known; (4) it spread from the Kirghiz Steppes in all directions, north and south, and east and west; (5) it followed the lines of human intercourse; (6) its rate of diffusion was less rapid than was at first believed, and not more rapid than could be accounted for on the theory that it was spread by contagion alone; and (7) there is much positive evidence of the spread of influenza by contagion in Russia, even in towns near to the place of origin of the epidemic and in the earliest days of its course.

International Bicycle Race.

An international bicycle race took place recently at Paris, in the Winter Velodrome, between Schofield and Linton, of Great Britain, and Medinger and Barras, of France. The course was 25 kilometers—about 15½ miles. At the fourth lap an accident occurred which quite spoilt the race, as one of the English competitors was obliged to retire. One of the pedals of Linton's machine broke, and Schofield, who was close behind, was thrown to the ground and abandoned the race. Linton continued riding with one pedal until another machine was brought out to him, when, by splendid riding, he succeeded in overtaking the Frenchmen, who by this time had gained a considerable lead. He kept in front until the last lap, when he was passed by Barras, who crossed the line a length before him. Linton was loudly cheered by the spectators for his plucky riding.

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TRICOLOR PHOTOGRAPHY.

While photography in colors is still a thing of the future, it is now possible to show pictures in natural colors by means of uncolored positives used in connection with color screens, the photographic positives being of such a nature as not only to define the outlines of the elements of the picture, but also to control the amount of each of the primary colors entering into the picture. The scheme is not a new one, several eminent scientific men in Europe having experimented in this direction, and Mr. Ives in this country having done a great deal toward perfecting this branch of photographic art.

Recently Mr. R. D. Gray, the well known photographic lens manufacturer of this city, has taken up the subject and carried it to such a degree of perfection as to render it possible to show these beautiful pictures to a large audience nearly as readily as ordinary lantern pictures are shown. He has discovered a particularly good combination of colors for his screens, for taking and projecting views. The colors used for the screens are red, green, and blue, which are slightly modified. On the modifications of these colors depends the success of color photography as now practiced. Of the hundreds of commercial dyes examined by Mr. Gray, not one of them used alone would answer the purpose. After a great many experiments he finally succeeded in effecting the combination of several colors that would fill the requirements. These three color screens, red, green, and blue, in their modified form stand for all the colors of the spectrum.

A positive made from a negative taken through a red screen is transparent in all places where pure red is seen in the subject represented, also more or less in parts representing purple, or violet and orange. A positive taken through the green screen will be transparent in the parts that are green in the subject represented, it will be transparent also in parts representing yellow. In a similar way a picture taken through a blue screen is transparent in the parts representing the blue portions of the subject.

In the illustrations, Fig. 1 represents a transparent positive printed from a negative taken through a red screen; the central spray of the gladiolus is nearly white; in a glass positive it would be nearly transparent. The right hand spray is light gray in color, which in a glass positive is semi-transparent, so that light could go almost unobstructed through this part of the positive. The main portions of the petals in the left hand spray are white, or in a glass positive transparent, while the fringes of the petals are only semi-transparent. The leaves and stalks are very dark, almost opaque, and some of the buds are dark. Now, when the transparency represented by Fig. 1 is projected on the white screen by a beam of red light, all the parts which are here shown light or white will be a more or less brilliant red. The perfectly transparent parts will be bright red, while the gray or semi-transparent parts will be less brilliant.

The glass positive represented in Fig. 2, which is taken through the green screen, is opaque in the parts representing red, but is transparent in the parts representing white, and more or less transparent in the parts representing green and yellow, so that when this positive is projected with green light, the green leaves, stalks and buds receive their proper amount of pure green, and the white portions receive the amount of green which is required in the composition of white light.

In Fig. 3 is shown a glass positive taken through a blue screen, and after what has been already said it will be understood that in this picture, wherever white or gray is shown, the glass positive is transparent, or partly so, thus allowing the blue light with which it is projected to pass in portions representing parts of the object in which more or less blue is necessary in their representation. The central spray being transparent in each picture, allows the red, green, and blue light to pass through to the screen, and the three pictures being accurately registered, these three primary colors when projected in their full strength upon the screen produce white light. Where the blue and green are screened off by opaque portions of the positive, and where the corresponding portion in the positive representing red is transparent, only the red light will show in such parts. In the view in which the green portions are represented and through which green light is thrown upon the screen, the red and blue parts of the picture are opaque; the positive representing the parts containing the blue is opaque in those parts representing the red and the green. By superposing the three pictures on the screen and allowing the beams of light to combine in different proportions in different portions of the picture, or to be shown on the screen uncombined or pure, every color in the spectrum is represented. Under these conditions the right hand spray shows red petals with borders slightly tinged with purple; the left hand spray shows pink petals with the fringes also tinted with purple, and the green is modified by a small proportion of red and blue.

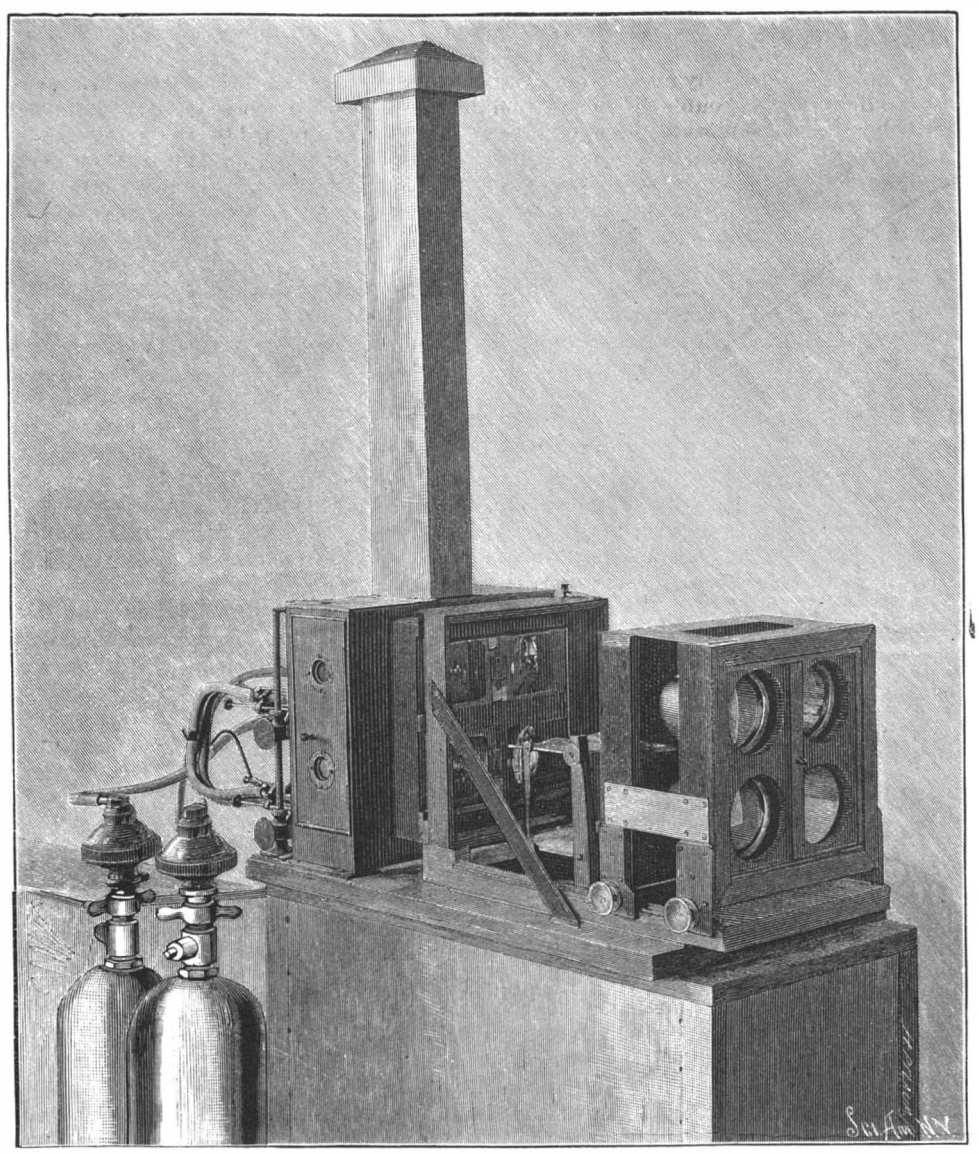

Fig. 4.—TRIPLE LANTERN FOR PROJECTION OF PICTURES IN NATURAL COLORS.

The lantern which Mr. Gray uses for the projection of these pictures is shown in Fig. 4. It consists of three oxyhydrogen lanterns carefully adjusted so as to cause the pictures to register on the screen when the lantern is located at a certain distance. The three positives which are required for the projection of a single view are fixed in a rigid frame, which, when it is inserted in the lantern, brings them into proper relation with the condensers and objectives. Either before or behind the frame carrying the three positives for projection is placed a frame carrying three colored screens, each being placed behind a positive which was made through a screen of the same color. When the images of these three positives are made to coincide on the screen, by means of suitably colored beams of light, although there is no color upon the views themselves, the composite picture on the screen presents all the colors of the thing represented.

Mr. Gray spent a large portion of last year taking views in the Yellowstone National Park, Yellowstone Canyon, and in California. These views were shown in New York at Chickering Hall, also in Brooklyn before the Brooklyn Institute. In each case the spectators were surprised and delighted with the results.

AT Forest City, Pa., in the Forest City coal shaft, is what is claimed to be the most powerful electric motor in the world for use in mines. It is mounted on a car 39 inches in height, 6 feet wide and 12 feet 8 inches long. It is rated 75 horse power and is designed to pull 90,000 pounds up a three per cent grade at the rate of 6 miles per hour. The motor is wound for 220 volts. It is used to draw cars a distance of 5,000 feet, and, with a train of 19 loaded cars on the outward trip, the round trip is made in less than 10 minutes. The engine furnishing the power is of 150 horse power capacity.

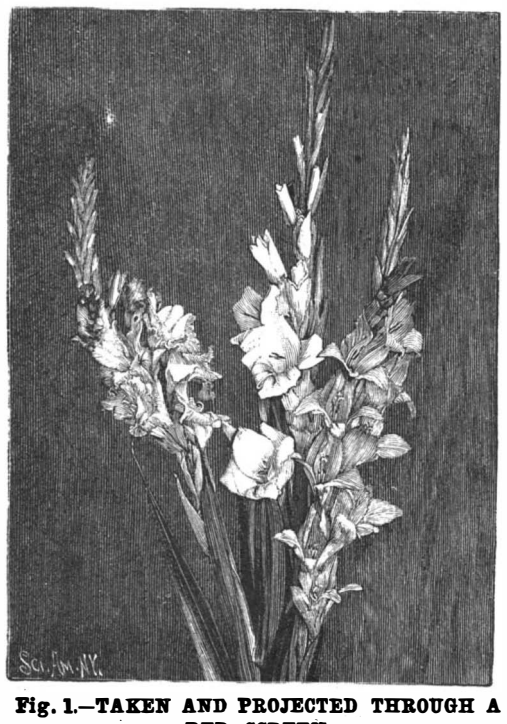

Fig. 1.—TAKEN AND PROJECTED THROUGH A RED SCREEN.

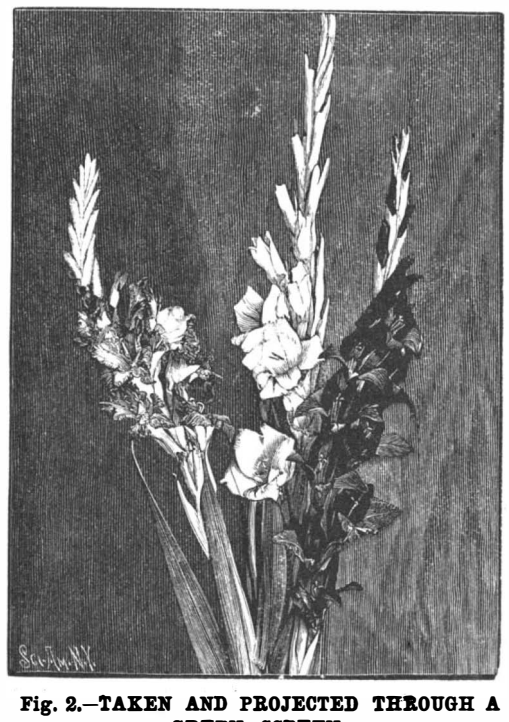

Fig. 2.—TAKEN AND PROJECTED THROUGH A GREEN SCREEN.

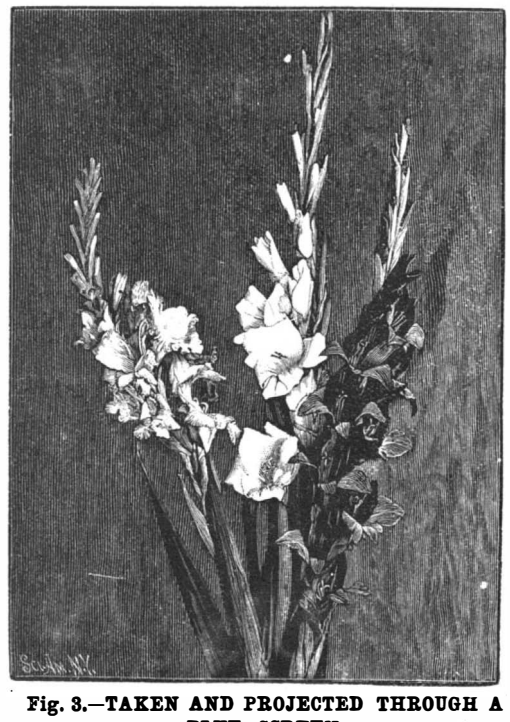

Fig. 3.—TAKEN AND PROJECTED THROUGH A BLUE SCREEN.

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Correspondence.

The Water Power of Augusta, Ga.—A Correction.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN dated February 3, 1894, on page 67, top of first column, subject "Niagara Hydraulic Works in Operation," kindly allow me to correct an error.

You refer to $8 per H. P. per year, 24 hours to the day, as being the cheapest power ever obtained [said to be].

The city of Augusta, Ga., has been for years, and still is, furnishing thousands of H. P. to all who want it at the rate of $5.50 per H. P. per year of 24 hours to the day, or 25 hours per day if necessary. A magnificent canal 7 miles long, with masonry dam across the Savannah River, furnishes at present about 12,000 H. P. to cotton, flour, yarn, and other kinds of mills, electric street railroad, electric power plants, electric lighting plants, and other uses, with a capital invested of about $8,000,000 or $9,000,000.

Augusta, Ga. W. E. JACKSON, JR.

Winding a Motor for 110 Volts Potential.

To the Editor of the Scientific American:

Having seen on different occasions inquiries about speeds of motors as published by you in the SCIENTIFIC AMERICAN, I have built one as described in "Experimental Science," page 494, following all directions except the wiring. I wired the field with five pounds of number eighteen single-covered cotton wire, and the armature with fifty feet of number twenty-two silk-covered wire. As a motor it is quite a success. I attached it in a circuit of 110 volts in series with a fifty candle power thirty-five volt lamp, had it running over five hours at a speed of fifty-five hundred revolutions per minute. As a dynamo it will light an eight candle power lamp by putting in as a shunt between the two binding posts about twelve inches of number thirty iron wire. Hoping that this will be of some information to the young readers of the SCIENTIFIC. PAUL J. CHASSAGUE.

Akron, O.

Copying from Nature.

That the designer who copies from nature is the one that attains success most readily cannot be doubted, says the *Commercial Bulletin*. The days of copying from old designs are fast going, and now the designer who would keep up with the times must be as original as possible. This has been said many times before by many writers. The most unique method of designing direct from nature, thus assuring originality, is a way which your correspondent has had explained to him recently by one of the designers in a Lawrence mill. This man has designed fancy figured effects for intricate shawl patterns for many years. Since the advent of the demand which calls for a closer imitation of nature in designing, this man has found it to be advantageous to copy from flowers. His ability to copy offhand from a flower model is deficient; so the man does like this: He gets a bunch of roses, or a twig of leaves and buds, and places these upon his design paper. A light pressure with his hands flattens the objects upon the paper sufficiently to permit a true outline to be made of each leaf or flower. This outline he makes by the use of a pencil. Then he is sure of getting the correct forms of the figures. After he has made the outline of each leaf and flower, the bunch is removed and he proceeds to fill in the shapes. Then he checks off the risers and sinkers according to the outlined forms, and thereby is sure of getting the correct shapes of the objects into his design. This appears to be quite a novel way of copying from nature. Any one can do this.

A Rooster in the Pulpit.

On a recent Sunday morning, so says the New York *Tribune*, "the Rev. Dr. Tyndall, of the Broome Street Tabernacle, in this city, decided to preach a sermon to his flock showing how the devil hypnotizes people. And it occurred to him that some striking illustration of this fact in demonology would be very impressive. Of course, the best possible illustration would be the devil himself shown in the act of hypnotizing; but for many reasons the doctor was unable to secure the services of that nether personage. He has, however, been illustrating his sermons for some months past and is, therefore, not easily daunted. So he procured a large, able-bodied rooster, and at the proper point in his sermon placed it on a horizontal blackboard. Then he held its bill down on the board, and from it drew a chalk line. The incident mightily puzzled the rooster, which stood in a trance, looking at the doctor, who then announced that sinners were hypnotized by the devil in just the same way. While this illustration doubtless impressed the preacher's point on the people, it is open to one criticism. It made it necessary for Dr. Tyndall, for the time being, to enact the part of the devil, a character which we are sure is abhorrent to that good man's nature."

Wild Camels in Arizona.

The camels now running wild in Arizona are the descendants of a small herd originally imported for use in the State of Nevada. In the early days of mining on the Comstock, long before there were any railroads in the Great Basin region, it was thought that camels might be profitably used about the mines, particularly in packing across the surrounding deserts, and twelve "ships of the desert" were accordingly purchased and brought to Virginia City. They were wanted for use in packing salt from the Salt Springs salt marsh to the Comstock reduction works. This salt deposit lies far out in a desert region, and to reach it many waterless stretches of sand and alkali had to be traversed.

The camels were able to cross all the deserts in perfect comfort, carrying heavy loads of salt and finding means of subsistence in the prickly and bitter plants and shrubs everywhere to be found in abundance. In short, the animals did as good work here in our deserts as they are able to do in any country in the world, but they were too slow. The camel may be fast enough for an Arab, but he is too slow for an American.

When the occupation of the camels as packers of salt was gone they were sold to some Mexicans, who used them for a time in packing wood down out of the mountains. The Mexicans took them up rocky trails into the rugged hills and used them the same as they used a mule—unmercifully. They soon killed three of the wretched beasts, and would have killed the remainder had not a Frenchman, who owned a big ranch on the Carson River, below Dayton, taken pity on the poor, abused creatures and bought the whole of them. This Frenchman had been in Algeria with the French colony, where he had developed an affection for the camel—probably owed the animal a debt of gratitude for having saved his life on some occasion. He had no use for the beasts, therefore turned them out to roam the desert plains at will.

The animals, left to shift for themselves, soon waxed fat, and increased and multiplied. In a few years from nine the herd had increased to thirty-six, old and young. The Frenchman then sold the whole lot to be taken down to Arizona to be used in packing ore down off a big mountain range. It was said there was a good smooth trail, but the animals found all the rocks and soon became footsore and useless, when all were turned adrift to shift for themselves. They have regained the instincts of the original wild state of their species and are very wary and swift. They fly into waterless wastes impenetrable to man when approached. Some of the old animals, however, occasionally appear in the vicinity of the settlements. Of late it is reported that the cattlemen have been shooting them for some reason, perhaps because they frighten and stampede their horses. No one knows how many camels are now running at large in the wilds of the Gila country, but there must be a great number. One is occasionally caught. Four years ago one was captured near to Gila Bend that measured over nine feet in height. It appeared to be a stray from one of the herds in that region.—*San Francisco Chronicle.*

An Easy Method of Keeping Warm.

I should like to call attention to an easy method of warming one's self when other and more common means are not available. It is a method that I suppose is well enough known to the profession, but probably not often used. I allude to warming the body by merely taking deep inspirations.

On one very cold afternoon of this winter, though walking briskly along, I was uncomfortably cold; feet and hands were very cold, and my ears so chilled as frequently to require the application of my heavily gloved hands. In addition, the whole surface of the skin was unpleasantly chilled; "creeps" ever and anon running up and down my spinal column and radiating thence over the body and extremities; in short, a condition that every reader of this little article has doubtless many a time experienced. I then began taking an exercise often employed before with benefit; deep forced inspirations, holding the air as long as possible before expulsion. After a few inhalations the surface of my body grew warmer, and a general sense of comfort pervaded me. Continuing, the next to feel the effects of the effort were my previously frigid ears; they grew agreeably warm, and within the time required to walk three blocks, at the previous pace, hands and feet partook of the general warmth and I felt as comfortable as if the same length of time had been passed by a glowing fire.

The happy results obtained from this simple method are probably owing to several causes:

The cold of course chills the surface of the body and contracts the superficial blood vessels, usually affecting first hands, feet and ears, and afterward the general body surface. Contraction of the blood vessels results both in less blood to the part and in stagnation of the current, thus rendering the tissues still less able to resist the cold. Deep forced inspirations not only stimulate the blood current by direct muscular exertion, but also by compressing and expanding the lungs the flow of blood is greatly hastened through this organ, and on account of the increased amount of oxygen inhaled, this abundant supply of blood is thoroughly oxygenated, tissue metabolism is increased and more heat necessarily produced.

Many times unavoidable exposure, as in riding, driving, standing and the like, for a longer or shorter time in the cold, has been the cause of severe and even fatal congestive troubles, such as pleurisies and pneumonias, and a means of quickly stimulating the flagging peripheral circulation which a person has always with him, and which can be employed without moving a step, is one that ought not to be neglected or forgotten. —*E. B. Sangree, M.D., American Therapist.*

THE ANTWERP EXPOSITION.

The International Exposition of Industries, Arts, and Sciences, under the patronage of Leopold II., King of the Belgians, opens at Antwerp May 5, and continues until November 12. The exposition promises to be one of importance and interest. As may be seen from the birds eye view herewith given, the exhibition will be extensive. It will include industrial, scientific, and artistic productions, as well as all kinds of commercial produce, embracing, in fact, the whole range of human activity. It will comprise maritime, colonial and African sections, also an exhibition of military art. Simultaneously with the general exhibition, the Antwerp Royal Society of Fine Arts will hold a special exhibition of painting, sculpture, engraving, and architecture, to which artists of all countries are invited to contribute. It is also intended to hold a series of shows and exhibits of live stock, agricultural products, flowers, fruit, etc., under special regulations.

The exposition is located in the new quarter of the city, near the river Scheldt and the new maritime installations. It covers an area of about 200 acres, and is connected with the principal railways. The main buildings are extensive, covering some 1,100,000 square feet, and include halls for exhibiting industrial and commercial products, machinery, and electric appliances; also a festival hall, measuring some 54,000 square feet. The exhibition halls are built of iron and steel, and are roofed with zinc. Various other constructions will be erected in the gardens; in the grounds will be displayed trees, shrubs, and all kinds of products unsuitable for exhibition in the principal halls.

The American sections of the exposition are as follows: In the industry building, 60,000 square feet; electricity building, 30,000 square feet; machinery building, 30,000; American building, 12,000 square feet for exhibits in models or small articles; 14,500 square feet divided into rooms for States and government exhibits.

The United States has been recognized by the appointment of Stanislas H. Haine as vice-president of the exposition, and he is sent as a special commissioner to this country.

The American Propaganda has also been formed as official agent of the Antwerp Exposition. It will endeavor to secure a creditable representation of American industry, and collect and install exhibits as well as disseminate information.

The American building at the Antwerp Exposition is modern Renaissance in style. Its dimensions are 240×150 feet. The main facade on the south side will be one of the most beautiful in the exposition. The approach is by a broad marble stairway, which leads up to the grand vestibule, 110 feet wide. From the floor of the vestibule one can obtain a view of the entire exposition hall, which occupies the center of the building and covers 12,700 square feet. To the rear of this main exhibit hall will be a model shoe factory. On the east front, where there will be a separate entrance, the entire space has been divided between the rooms for the press and a commercial room, where catalogues and literature of exhibitors will be available for distribution.

The second floor is in reality a gallery surrounding the main Exposition Court, which is open to the dome. From this gallery a view may be had of the models on exhibition below, and access is given to the exhibit rooms of the various States which will be there represented. The largest of these exhibit rooms, which is 40×82 feet, is devoted to the United States government.

A triangular space near the building will be used as a fire station. The station will be fitted up with the latest electrical devices, fire alarms, and other devices for fighting fire. In this annex will also be an ambulance wagon.

In the center of the main hall will be an illuminated electric fountain. A band of twenty selected musical instruments will be stationed in the balcony. The entire building will be of iron, steel and glass.

For the foregoing and the illustrations we are indebted to the *Graphic*, Chicago, and for the following to *Engineering*, London: The buildings are continuous, and consist of a vast hall intended for the display of industrial arts; from this the visitor passes into a smaller building, devoted to electricity, and over a raised corridor into the Machinery Hall. None of these buildings are monumental in their proportions, or even

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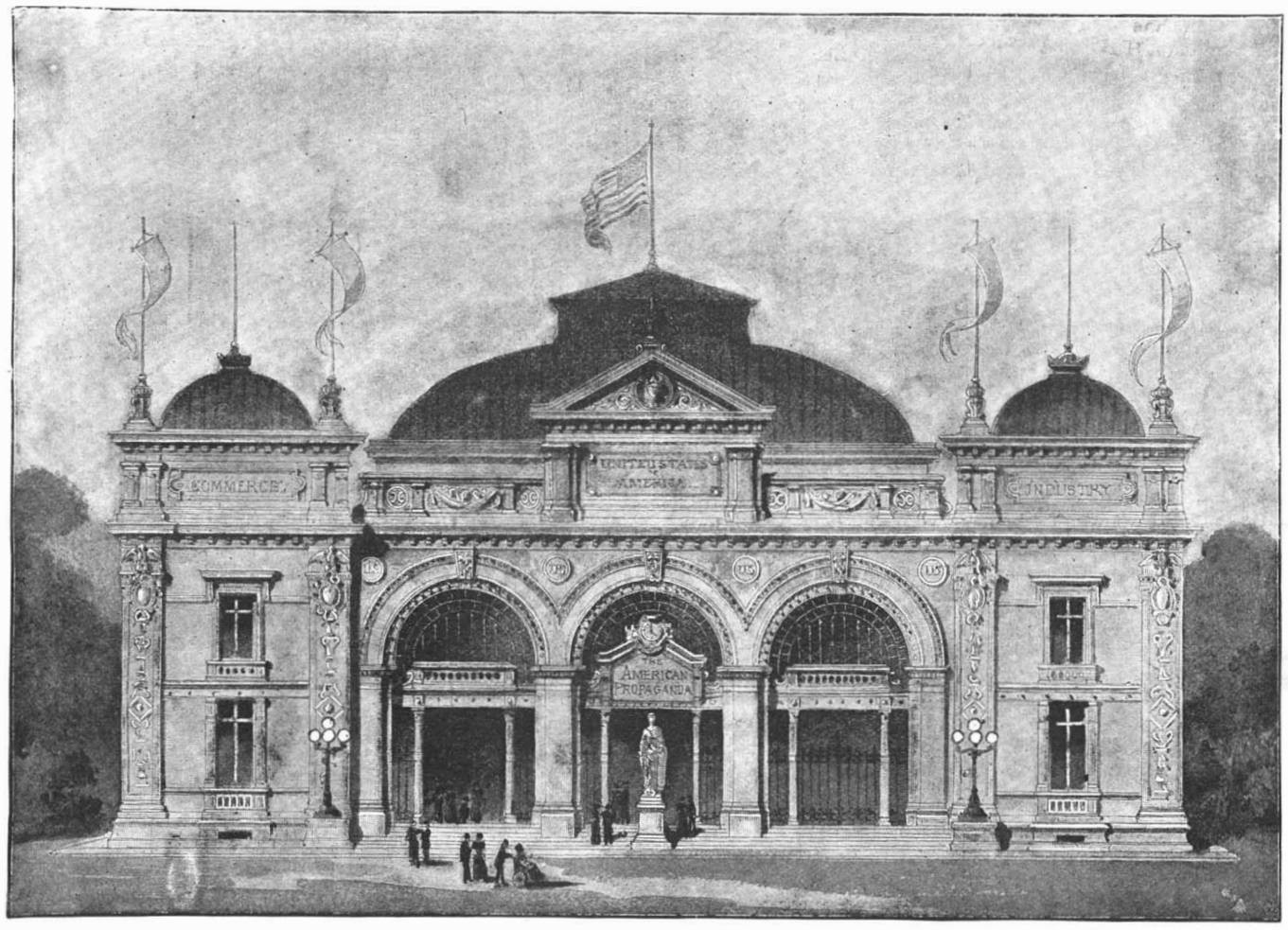
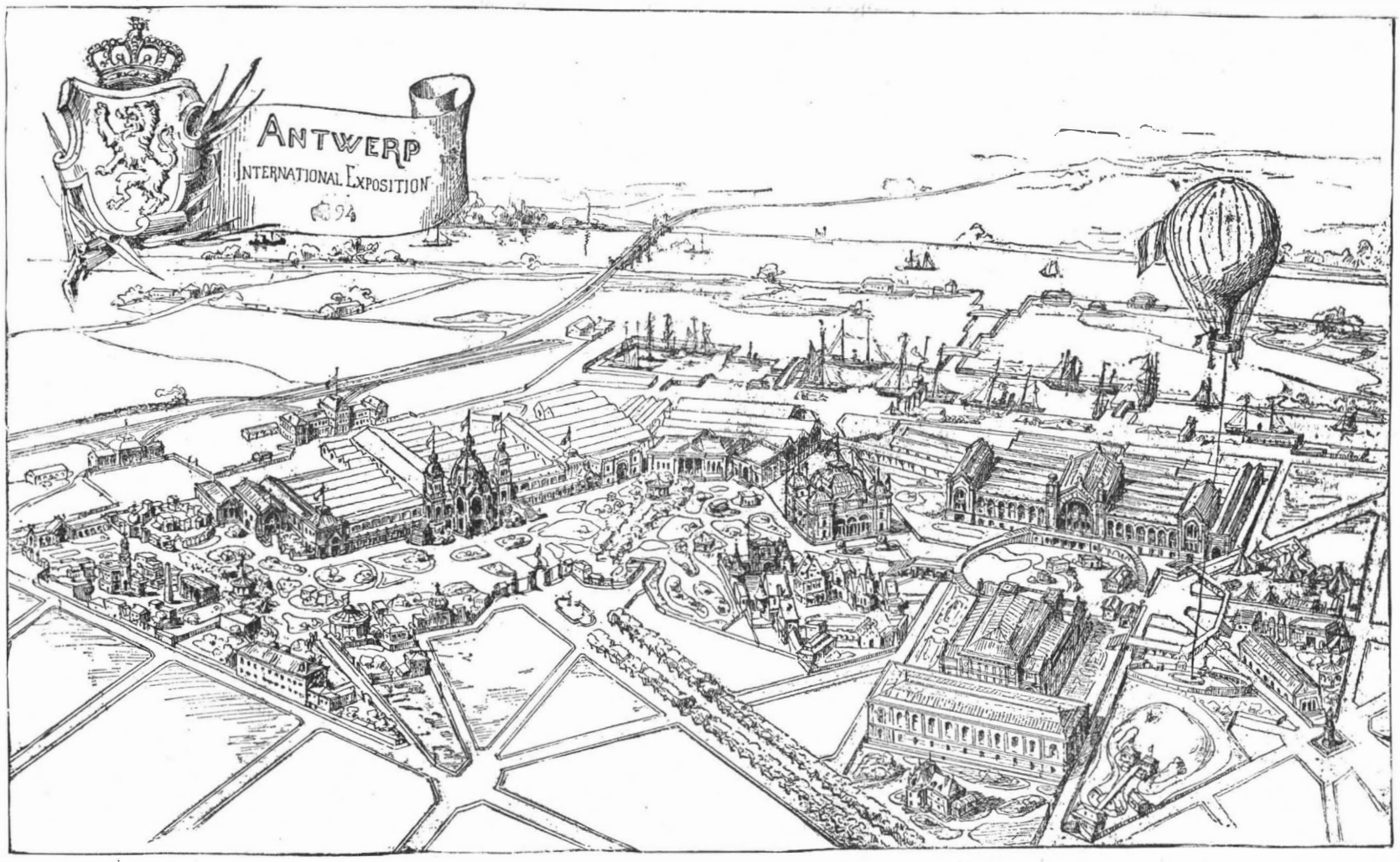
elaborate in their design. There is, indeed, a certain amount of decoration on the long low facade that forms the principal front facing upon the beautiful Avenue du Sud, one of the great boulevards of Antwerp. But no money has been spent upon ornamental effects. The roofs are all small in span and simple in construction, the result being a long series of well-lighted galleries, unobstructed by heavy columns or the springings of massive arches.

A concert hall forms a part of the main buildings. This is an old and very spacious structure, having a seating capacity for about 5,000 persons, and in it, musical performances and temporary exhibitions will be held during the summer.

The main buildings cover an area of 25 acres, or about one-third of that occupied by the thirteen great structures at Chicago. A sufficient part of the 200 acres constituting the park will be set aside for the landscape gardener, but much of it will be absorbed by important buildings and many pavilions; the inevitable Rue de Caire shall, it is intended, eclipse that of the Midway Plaisance in Chicago; there will be a panorama, a Turkish village, a Chinese bazar, a captive balloon, an Indian village, and so forth, but the chief of these outdoor attractions will be the Congo Settlement and the reproduction of old Antwerp. In the former will be brought together such a collection of realistic objects as shall give a clear idea of the great district in Africa in which the Belgians take so profound an interest. In the Antwerp of the sixteenth century will be presented reproductions, complete in every detail, of no less than ninety famous old buildings associated with the varied fortunes of Antwerp during the last 300 years. Realism will be carried to its highest pitch in this quarter of the exhibition, for not only will the houses be perfect in every detail, but the most minute care will be exercised in the dresses of all the occupants of these houses, where the pursuits of the sixteenth century will be carried on. Here also will be held many of those gorgeous historical fetes and processions for which Belgium is famous.



THE AMERICAN BUILDING OF THE INTERNATIONAL EXPOSITION, ANTWERP.



BIRD'S EYE VIEW OF THE ANTWERP EXPOSITION.

Vibrations of Tall Buildings.

During the recent storm in Chicago, when the velocity of the wind as observed at the United States Signal Service station was as high as 84 miles an hour, observations were taken of the vibrations of the Monadnock and Pontiac buildings by Mr. W. L. Stebbins, civil engineer. An exceedingly sensitive level in which one division on the scale shows a variation of five seconds was set up on the eleventh floor of the Monadnock in Mr. Stebbins' office, and the time of the vibrations was observed to be about two seconds. A 14 ounce plumb-bob was then hung in the north air well, the point of suspension being on the sixteenth floor, and the plumb-bob itself vibrating just above a drawing board placed on the second floor. The curve here traced was a circle one-half inch in diameter. The plumb-bob was then suspended in the south air well, extending from the seventeenth to the second floors, and the observed curve was elliptical, the major axis being north and south and seven-sixteenths inch in length and the minor east and west with a length of three-eighths inch. In the Pontiac building the same plumb-bob hung in the freight elevator shaft from the fourteenth floor gave an elliptical curve with a major axis one-fourth inch long and extending east and west, the north and south axis being three-sixteenths inch. Observations were also taken in the Monadnock building with a transit sheltered so as to be unaffected by the wind. The one taken in the northwest corner showed a vibration of one-fourth inch and that in the southwest corner an average vibration of one-fourth inch with a maximum of one-half inch.

The Monadnock building is 400 feet by 67 feet and 182 feet high, the largest dimension being in the north and south line. The north half is built of heavy masonry, while the south half, being of more recent construction, is a steel framework, with light walls. It may be noticed that the greatest vibration of the south half was in the direction of the length. The Pontiac is of steel frame construction, and is 100 feet by 68 feet and 175 feet high, the length being in the same direction as that of the Monadnock. The wind during the storm was northeast.

ACCORDING to careful estimates, three hours of close study wear out the body more than a whole day of hard physical exertion.

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RECENTLY PATENTED INVENTIONS.

Engineering.

ROTARY ENGINE.—James C. Walker, Waco, Texas. This engine has four independent annular steam chambers, each provided with but a single piston and sliding abutment, the arrangement being adapted to give a live steam impulse upon the shaft at each quarter revolution, to not only gain increased speed and power, but insure a full expansion of the steam in each chamber, and without giving a jerky, irregular motion to the shaft. Owing to the peculiar relation of the pistons and abutments, and simple gate-operating devices, as steam is cut off from one chamber the valve inlet discharging into another chamber is being opened, the exhaust port in each of the chambers being located in advance of the sliding abutment.

PRESSURE GAGE.—Henry Rauser, Charles Wieber, and Alexis Sokoloff, Moscow, Russia. This device is so constructed as to relieve the parts of the gage from excessive strain by reducing the pressure of steam or other medium before it acts on the indicating column. It has two communicating tubes, one employed as a gage tube while the other serves as an expansion chamber for the inflowing steam to act on the liquid in the communicating tubes, a tube being also provided for the exhaust steam, of sufficiently reduced diameter to prevent the steam from escaping out of the expansion chamber without acting on the liquid. With this improvement a short gage glass indicates a wide range of preasure, and there is no danger of the glass bursting.

Railway Appliances.

CAR STEP.—Lemuel S. Manning, Alessandro, Cal. This improvement provides an extensible step or tread piece in the steps for platforms of passenger cars, with means for locking the step in position, being designed to facilitate entrance to and exit from the cars in places where the height of the car platforms from the ground is above the regular distance for which the fixed steps are provided. Hanger plates vertically movable on the fixed steps carry an auxiliary step, the hangers being provided with longitudinal slots having transverse branches into which extend the arms of a conveniently actuated rock shaft, the extension being very quickly made as occasion arises, the auxiliary step being swung down the desired distance.

CAR PLATFORM.—The same inventor has devised a self-adjusting extension or apron for the fixed platform of a car, to bridge the space intervening between the ends of two coupled cars and afford a continuous passageway from one car to another, conducing to the safety of passengers and trainmen. The invention provides a novel arrangement of apron and buffer block, whereby they accommodate themselves to the side movement of the cars, so that the apron will be maintained in conjunction with an adjacent platform on a coupled car while the cars are on a curve as effectively as if on a straight line.

CAR VESTIBULE.—In line with the invention above noted, the same inventor has provided improvements in vestibules for cars, that they may coact with his improved telescopic car platform, and which may also be applied to any longitudinally yielding platform, and afford shelter as well as safety for passengers moving from one car to another. The vestibule consists of a flexible waterproof cover secured in arched form over and on each side of the end door, an arched supporting frame being made in two sections connected at the top, and telescopic braces being connected to the frame and the end of the car.

DOOR FOR CAR PLATFORMS.—This is a further invention of Mr. Manning relating more particularly to doors for passenger cars that are furnished with vestibules, whereby the doors are adapted to furnish guards for the floor openings at the car steps at the sides in the body of the car near the ends. According to a feature of this improvement the floor of the car is rendered intact when the side car doors are shut, and the step passages are automatically opened when the doors are similarly adjusted. The invention provides a neat, simple, and practical construction, preventing the entrance within the car of dust and air draughts.

GRAIN CAR DOOR.—Joseph H. Goode, William H. Anthony and Thomas S. Lloyd, Richmond, Va. This door is hinged to swing inward, and its bottom does not extend to the car floor, where a grain discharge opening is left the full width of the door, such opening, when the car is filled, being closed by a slide or cut-off. The slide is an angle iron casting, its upper portion being made as a rack with which engages a cog gear actuated by a crank handle on the outside of the car, the handle being held locked by the car seal until the load is to be removed, when the slide may be drawn back the desired distance to afford a discharge mouth under the door.

FENDER FOR STREET CARS.—William H. Brock, Brooklyn, N. Y. This fender is adapted to be moved forward beyond the platform when desired, and withdrawn beneath the platform when not required for use, the motion of the car being utilized to effect such forward and backward sliding movement through a gear on one of the car axles, with which an upper or lower rack on the fender may be brought into engagement. The fender will be moved in or out, according to the direction in which a lever is moved that extends above the car platform in convenient reach of the motor man or grip man.

CAR REPLACER.—Philip J. Schmidt and George Weber, Hoboken, N. J. This is a simple and effective adjustable support for a derailed car and its truck, affording convenient means to facilitate the use of opposite lifting jacks of any approved make. The improvement comprises two bearing blocks of novel form, to be used with a connecting bar loosely engaging the blocks, whereby a suitable support will be made for the truck frame, enabling the jacks to be advantageously applied.

CAR AXLE BEARING.—William J. Tripp, New York City. The cylindrical hub of the car wheel, according to this invention, projects into a journal bearing in which rollers are interposed between the hub and bearing, while a journal box has vertical sliding movement in guideways of the truck, the journal bearing being adapted to be turned in the journal box. Locking means are provided to engage with the bearing and the surrounding box to hold the parts in their relative positions, the bearing being turned from time to time, according to the wear, so that a new surface will be brought into use, prolonging the wear of the journals.

Electrical.

ELECTRIC RAILWAY.—Benjamin F. Comstock, Decatur, Ill. This improvement provides for running a double track electric railway from a single trolley wire, the trolleys of two meeting cars passing each other on the same wire without injury. The outer end of each trolley arm has an attached metallic plate with flanged rollers near each end, and the ends of the plate are tapered or pointed, the points of the plates being so small as to be free from liability of catching, and one trolley riding over the plate of the other trolley as two trolleys meet and pass each other.

SIGNALING APPARATUS.—James W. English, New York City. This is an improvement in apparatus in which visual signals are swung from a hidden to an open position. A number of targets are arranged in series, each comprising a common staff and oppositely projecting signal flags, an electric motor being geared to swing each target, while the mechanism is contained in a case having a single sight aperture before which the targets appear. The motors are independent of each other and may be worked from any ordinary switch board.

Agricultural.

PLANTER.—James E. Betts, Wilmington, Ohio. This machine is designed to work well in fields where there are stumps or trees, or upon uneven ground, has a simple means for regulating the drop of the seed and is provided with a marker which drops marking material simultaneously with the dropping of the seed. This improvement may be attached to any planter, and the construction is such that the drop may be made sooner or later than ordinary, which is an advantage when passing over raised places, or where the rows become longer and only the same number of hills may be made.

HAND SEED PLANTER.—James M. Basket, Leota Landing, Miss. This is a device for planting corn, peas, beans, etc., and is so made that both its main stem and lever may be grasped by and operated with one hand while walking briskly along. The main stem has a trowel point, and at one side is a seed box holding as much as may be conveniently carried. The point of the trowel is forced into the ground at an angle as the operator moves along, and the opening for the seed is enlarged by bringing the implement to the perpendicular, when the operating lever is pressed to move the seed slide and discharge the seed, the earth falling into the hole as the trowel is withdrawn.

Miscellaneous.

MARINE SIGNAL.—Frances V. Stewart, Atlanta, Ga., administratrix of George W. Stewart, deceased. A sliding and swinging signal head, having a bell mouth, is, according to this invention, arranged at the bow of the vessel, and contains a steam or compressed air chamber, connected by a telescoping tube and pipe with a source of supply on the vessel, a whistle being arranged in the head. The bell mouth is also adapted to receive sounds made by a corresponding apparatus on another vessel, and is connected by flexible tubing with the pilot house. This apparatus is designed to make the water the medium by which sound is transmitted and received.

REIN HOLDER.—Thomas J. Weir, Cincinnati, Ohio. This device comprises a fixed section, to be secured to any overhead support, as to the front bow of a canopy, and a pivoted swinging section, which may be adjusted higher or lower. The reins may with this holder be held so that they will clear the horse's tail while driving, and they may also be readily clamped to the hood or other portion of the vehicle to which the attachment is applied. The device may also be adjusted to serve as a lever, enabling the driver to check any sudden start of the horse.

ANTI-RATTLER FOR THILL COUPLINGS.—Frank P. Johnson, Danville, Pa. This device is self-adjusting to all styles of coupling. It is made of two spring-connected wire loops, a wear plate extending the length of one of the loops, and a yoke movably located upon the opposite loop. The device is inexpensive, is designed to have a maximum amount of bearing surface on the coupling, and to automatically take up wear.

DUMPING WAGON.—Alfred J. Thompson, Kaufman, Ill. The body of this wagon is pivotally connected by links with the truck and adapted to slide on inclined tracks, a rope being attached at its ends to the under side of the body, and the rope passing over a windlass. The wagon is especially designed for hauling and dumping broom corn and similar material.

HORSE DETACHER AND BRAKE.—Annie H. Chilton, Baltimore, Md. This invention provides simple and inexpensive devices, readily applicable to any vehicle, whereby the horse may be quickly detached from the shafts, the shafts held from the ground, and the brakes applied simultaneously. The several parts are released by a rod, chain or cord extended into the vehicle body in convenient reach of the driver. Should the horse fall, he may be released by the same means, and by drawing the wagon backward; the shafts, being connected with the body by spiral springs, will yield and not be broken.

DRYING APPARATUS.—Edward Robinson, 4 Castelnau Gardens, Barnes, London, S. W., England. This is an apparatus for drying tea, sugar, grain and other substances, in which volumes of heated air are obtained by means of a spirally constructed heater and driven into a revolving spirally constructed drier adapted to carry and pass through it the material to be dried. The apparatus can be driven at any required speed, to pass the material quickly to be dried, or to prolong the operation according to the time required to complete the work.

DISTILLING APPARATUS.—Frank E. Wallace, East Orange, N. J. This is a simple and durable apparatus, more especially designed for household use. It consists of a series of centrally connected vessels located one above the other and all supported in a suitable frame, each vessel having a water and steam distributing plate arranged centrally above its outlet, while one outermost vessel is connected with a boiler and the other is provided with a trap forming an outlet for the purified water.

MAKING PHOSPHATIC FERTILIZERS.—John Gregory, Newark, N. J. Boneblack which has been used as a filtering material for various oils may be made into a fertilizer in a cheap and simple manner by a process devised by this inventor, which consists principally in mixing the material with sulphuric acid, and then boiling the mixture, when the boneblack forms a filter for the oil and other fatty substance contained in it.

PORTFOLIO.—Wladyslaus Jeschke, Brooklyn, N. Y. This article is made in folding sections, quite narrow when closed, but the covers having sufficient area when opened for use to support sheet music of full size. A retaining device holds the cover in open position when straightened out, and also holds it closed when folded, in neither case interfering with the flexibility of the cover. The portfolio is compact, simple, inexpensive, and attractive in appearance.

MUSICAL INSTRUMENT.—Isaac St. C. Goldman, Los Angeles, Cal. This is a simple and inexpensive instrument, more especially designed for the use of beginners as a substitute for the piano. Its frame has a lower sound chamber covered by a sound board carrying frets over which pass the treble and bass springs, and a bass key lever carries a hook engaging a hammer adapted to strike the bass string, while toothed wheels are actuated by the hooks of the treble key levers to sound the treble strings. The instrument occupies but little space, being readily placed on a table or other support, and it may be made with the same number of octaves as an ordinary piano.

CAN OPENER.—David Earl and Abraham Goodman, Ashland, Ky. This opener has a flat handle extending beyond opposite edges of the can, a central pivot pin and cutting blades on each side of the pin. The pivot pin and blades are forced into the top of the can, and the handle is turned, its movement a half revolution cutting a circular disk, which is removed by lifting the handle.

GAS BURNER.—Henry A. Fry, San Francisco, Cal. A burner adapted to heat the gas before it reaches the flame has been devised by this inventor, to afford the maximum degree of illumination. The burner has a hollow body in contact with which is a heat-conducting shell or lining provided with sockets, while a series of superposed but separated perforated disks have projections which enter the sockets, the metal tip being in contact with the body and its lining.

ICE PITCHER.—Frank E. Wallace, East Orange, N. J. This pitcher is designed to cool the water without bringing it into direct contact with the ice. In the open top of the pitcher is a spout having a flange forming a seat, with locking projections adapted to engage an annular flange upon an ice receptacle to be thus held suspended in the pitcher. The top of the receptacle is closed with a screw-threaded cap.

REFRIGERATOR.—George A. Bowen, Fond du Lac, Wis. This is an improvement on a formerly patented invention of the same inventor, and provides a refrigerator more especially designed for household use. The provision chamber is completely separated from the ice compartment, preventing any moisture from the ice entering the chamber, and ready access may be had to both compartments. The several parts can be readily removed for cleaning.

BREATHING TUBE.—Jacob T. Wilhide, Bruceville, Md. This tube is closed at one end and has graduated apertures in it near the closed end, on which turns a regulating cap with an aperture registering with any one of the graduated apertures. It is used to teach and insure proper and regular breathing, its open end being inserted in the mouth, the air being drawn in through the nose and exhaled through the tube, through one of the apertures registering with the regulating cap.

LAWN SPRINKLER.—Samuel H. Stott, Fullwood, Eng. A central vertical pipe having a spade point at its lower end to be forced into the ground is connected with a supply hose, and on the upper end of the pipe is screwed the novel form of sprinkler designed by this inventor, which is arranged to finely divide the water and discharge it in sprays, covering the ground uniformly in a circular area. The device may be conveniently cleaned, is not liable to become clogged, and is of simple and durable construction.

SHIRT BOSOM PROTECTOR.—Edward H. Carleton, Jr., Brooklyn, N. Y. This is a spring stay about the length of the side of the bosom, and provided with a series of spring clips or clasps adapted to grasp the bosom edge, holding the bosom partially away from the person of the wearer, and without creases or wrinkles. The device readily yields to any movement of the body, and the stay strips are not visible.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE ELECTRICIAN ELECTRICAL TRADES DIRECTORY AND HANDBOOK FOR 1894. (Twelfth year.) London: "The Electrician" Company. 1894. Pp. cxxx, 846. Price $2.

We are glad to receive this most useful manual now written up to date. Its characteristic feature, beyond the addresses and general information, is the biographical part, which we are glad to see has been brought well up to date. Among the portraits the place of honor is held by a full page engraving of Alexander Siemens, President of the Institution of Electrical Engineers.

THE INVENTIONS, RESEARCHES AND WRITINGS OF NIKOLA TESLA, WITH SPECIAL REFERENCE TO HIS WORK IN POLYPHASE CURRENTS AND HIGH POTENTIAL LIGHTING. By Thomas Commerford Martin. 1894. New York: "The Electrical Engineer." Pp. xi, 496. Price $4.

Mr. Tesla's work in the field of alternating current researches has been so striking, so novel, and has attracted so much attention, that this manual by the editor of our contemporary the *Electrical Engineer* is a welcome contribution to the physics of the day. The volume claims to be a simple record of the pioneer work done in his special department by Tesla, and the results of some ten years' work are included. It contains lectures and miscellaneous articles by Tesla, with discussions thereon; and furthermore, it treats of all his inventions thus far known, particularly those bearing on the transmission of energy by polyphase currents. The volume is issued with Mr. Tesla's sanction and approval, and is very elaborately illustrated.

THE LOCOMOTIVE. Published by the Hartford Steam Boiler Inspection and Insurance Co. New series. Vol. XIV. Hartford, Conn. 1893. Pp. iii, 192.

We are glad to note the receipt of the annual issue of this journal of the Hartford Steam Boiler Inspection and Insurance Co., in whose year's issue a large amount of most useful information is contained.

THE EVANSTON COLLOQUIUM. Lectures on Mathematics. By Felix Klein. Published for H. S. White and A. Ziwet. New York and London: Macmillan & Co. 1894. Pp. vii, 109. Price $1.50. No index.

Under the auspices of the World's Fair Auxiliary of Chicago, a congress of mathematics was held during the month of August. It was attended by Professor Felix Klein, of the University of Goettingen. After the adjournment a colloquium of mathematics was held at the Northwestern University at Evanston, Ill., and the present volume is a revised report of these lectures. The volume is of great interest, as giving the modern German view of the higher mathematics. The want of an index is to be regretted.

SCIENTIFIC AMERICAN BUILDING EDITION.

MARCH, 1894.—(No. 101.)

TABLE OF CONTENTS.

1. Elegant plate in colors showing a handsome suburban dwelling at Nutley, N. J., erected at a cost of $4,500 complete. Floor plans and perspective elevation. A tasteful design. Mr. E. R. Tilton, architect, New York.
2. Plate in colors showing an attrative residence at Providence, R. I. Perspective view and floor plans. Estimated cost $5,500 complete. An excellent design.
3. A dwelling recently erected at New Haven, Conn. Perspective view and floor plans. A unique design.
4. A beautiful residence at Edgewater, Chicago, Ill., recently erected for Clarence M. Stiles Esq. Perspective and floor plans.
5. Engravings and floor plans of a suburban residence erected at Belle Haven, Conn. An attractive design. Messrs. Boring & Tilton, architects, New York.
6. A suburban dwelling recently erected at Elizabeth, N. J., at a cost of $4,200. Floor plans and perspective elevation. Messrs. Charlock & Howard, architects.
7. A Queen Anne cottage at Ardmore, Pa., recently completed for Mr. Frank A. Apple. Floor plans and perspective elevation. An artistic design. Mr. J. M. Harlan, architect, Ardmore, Pa.
8. Two cottages at West Haven, Conn., erected at a cost of $2,050 and $2,200 each. Floor plans and perspective elevations. Mr. Rollin L. Hine, West Haven, Conn., architect. Instructive designs.
9. A Swiss cottage at Glenbrook, Conn. Perspective view and floor plans. Mr. D. W. King, New York, architect. An attractive design.
10. A Queen Anne cottage at Wyncote, Pa., erected at a cost of $4,300. Mr. Angus S. Wade, architect, Philadelphia, Pa. An excellent design.
11. An attractive residence at Hartford, Conn. Floor plans and perspective elevation.
12. Sketches of John Milton's cottage at Chalfont St. Giles, and interior view.
13. Page engraving, showing the west (main) facade of the new German Reichstag building, Berlin. Plans drawn by Paul Wallot.
14. Miscellaneous Contents: The decoration of the Pantheon.—A cheap and efficient water motor, illustrated.—Stamped steel ceilings and side walls, illustrated.—Waterproof masonry.—Graduated beam sliding calipers, illustrated.—The Jackson ventilating grate, illustrated.—Iron frame palm house at the Exposition, illustrated.—Mineral wool and its uses.

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The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

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Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5873) F. S. M. writes: 1. I am working Smee battery two 6×10 zinc and one carbon plate in 3 gallon jar. Is the jar large enough to obtain the best results, or would a larger jar be more economical? In silver plating brass forks, all of which were treated apparently precisely the same, some of them stripped entirely upon applying the burnisher, while the rest held the deposit nicely. Why? A. You would gain nothing by a larger jar, except that your battery would run for a longer period before exhaustion, and would give naturally a more constant current, or one more lasting, owing to slower exhaustion of the acid. You should have "quicked" your goods before plating. 2. What will cause brass articles to turn black and corrode in places when in the silver bath? A. Possibly want of cleanliness or irregularities in current strength. If spots appear while in the bath remove article, rinse, scratch brush, dip in cyanide of caustic soda solution, dip in quicking bath and start again. We can supply books on the subject, such as McMillan's "Treatise on Electro Metallurgy," $3.50 by mail, which gives many details.

(5874) A. W. B. asks: 1. The glass or joint snake, as it is sometimes called, will fly into pieces on being suddenly struck. I wish to know if an instance has ever been known where these pieces have united again, forming a perfect live snake (or lizard). A. We have no absolutely reliable record of such happening. See the SCIENTIFIC AMERICAN, September 3, 1887. 2. Will the Holtz electric machine generate electricity when turned backward? If not, why? A. It is not arranged to do so. The generation depends on the proper relation of the collectors and armatures.

(5875) J. H. T. writes: My house is wired for electric bells and burglar alarm, using a Leclanche battery of four jars. I want to place two or three automatic gas burners in cellar, etc., and would like to know whether I can make use of the same battery for this new gas lighting circuit? I would also like to know how to make a small spark coil to use with it. A. You can use the battery as described. For spark coil make a core ½ inch thick and 8 inches long, of straight pieces of iron wire, and wind it with four or five pounds of No. 22 magnet wire. We can supply Badt's "Bell Hanger's Hand Book," price $1, which treats on electric gas lighting apparatus.

(5876) P. G. asks: 1. What power can I expect from a water motor of the Pelton type, diameter of wheel ten inches, twelve buckets, water pressure eighty pounds, diameter of orifice one-quarter inch. A. Five-eighths of a horse power. 2. What would be the speed with no load? A. Nearly 2,000 revolutions per minute. 3. What would be the power, if the pressure were increased to one hundred pounds and the diameter of the orifice increased to three-eighths inch? A. Two horse power.

(5877) T. R. says: I have some mercury which is impure and adheres to the glass, rendering it useless for barometric purposes, for which I wish to employ it. Kindly state how it can be purified. A. Squeeze the mercury through chamois skin, then clean the mercury by covering with dilute nitric acid, one part of acid to three of water; allow the acid to remain on the mercury overnight. Pour off the acid and wash the mercury with water and remove the superfluous water with blotting paper.

(5878) L. M. B. asks: What power has a gasoline engine, double cylinder, 4 x 5 inches, at 300 revolutions, explosion every alternate stroke? What speed will above engine drive a 25 foot launch by 7 feet beam? What size propeller or wheel should I use? A. The gas engine is equal to 2½ horse power. Will give a speed of about 4 miles per hour. Wheel should be 20 inches diameter and make 175 revolutions per minute.

(5879) J. W. T. writes: 1. My wife makes sirup (molasses) for table use. Taking four tea cups of New Orleans sugar, she puts it into a pan containing two tea cups of water, allowing it to boil to sirup. It granulates when cool. Are there ingredients to prevent granulation? If so, how many and what is the theory of each? A. We suggest that you make your sirup by the cold process, or if by heat, that you use more water. Evaporation repeated often enough produces uncrystallizable sugar. A long cooking with addition of water from time to time would tend to produce genuine molasses. 2. Will pieces of zinc thrown in the stove rid the stove and stove pipe of soot? If so, what is the theory? How often should it be used? A. This we think is a fiction. No discernible action takes place in the direction of removing soot.

(5880) W. E. H. asks (1) how the broken end of any ocean cable is found. A. The end may be found by determining the resistance. Knowing the resistance per mile, the total resistance divided by this gives the distance of the break. If the conducting wire is parted within the insulation, the capacity is determined instead of resistance, and the location found by dividing this capacity by the capacity per mile of cable. 2. What, if any, difference between rocking and swinging motion? A. In swinging motion the body moves through the arc of a circle convex downward. In rocking, cycloidal curves are followed.

(5881) S. S. H. asks: 1. The proportion by volume of gas from gasoline and air that is used in the ordinary explosion engine? A. 30 to 40 vols. 2. The pressure per square inch exerted at moment of explosion? A. About 150 pounds per square inch. 3. The reason for using but one end of piston, or exploding in only one end of cylinder, and consequently exerting power on but half of each revolution? A. To avoid overheating. See SUPPLEMENT, Nos. 715 and 716, on the gas engine.

(5882) H. B. asks: 1. What are the elements in a battery using bisulphate of mercury in solution with water as exciting fluid? A. Zinc and carbon. 2. I have a polarized Leclanche porous cup that I have refilled with black oxide of manganese and powdered carbon, but it does not work. What is the reason it fails to fix it? A. Possibly your carbon was of poor quality or your binoxide of manganese may be poor. The pores of the cup may be choked. 3. What is the granulated chemical inside of the carbon cylinder of the Samson battery? A. Sal ammoniac.

(5883) J. C. W. writes: 1. Would it be any disadvantage to have the core to the field magnet to the motor described in the SUPPLEMENT, No. 641, cast instead of built as therein directed? A. It would be a slight disadvantage, but might be counteracted by making the core thicker and shorter. 2. What fraction (approximately) of a horse power would it develop with 6 cells, plates 5 inches by 6 inches, of plunge battery connected in series? A. Two or three one-hundredths of a horse power. 3. Would that be sufficient power to run a wood-turning lathe, swing 6 inches and 3 feet bed, by belting upon a light countershaft? A. Yes; for light work. 4. In a tangent-spoked bicycle wheel are all the spokes subjected to an equal strain if the wheel is stationary and the weight, of course, being applied at the center? A. Yes; if nipples are properly set up.

(5884) C. E. asks: On holding a piece of metal of some size closely against the vibrating spring or iron armature of a large induction coil, sparks pass to the metal, although this is insulated from the circuit. Is this phenomenon due to the extra current of the primary wire? A. The phenomenon is one of discharge from the primary or from the condenser connected thereto.

(5885) P. F. M. asks: 1. Can motor in SUPPLEMENT, No. 641, be used as a dynamo? If not, what changes are necessary? A. It should have a cast iron field or else have a separate exciting current for the field. 2. Can a storage battery be charged by a dynamo deriving its power from a windmill, or would the variations of speed in the windmill cause trouble to the dynamo? A. It can be so charged, arrangements being provided to open the circuit if the windmill ran too slowly.

(5886) H. K. B. asks: Is there a difference between an electric bell that will ring only with two wires and one that will ring on a single wire, ground return? How many gravity cells will be required to ring it through 200 feet of copper wire No. 11 B. W. G.? A. There is no difference. If for occasional and not continuous ringing, use two or three Leclanche cells. Three or four gravity cells would answer, but would not do on open circuit.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

March 6, 1894,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Alarm. See Boiler water alarm. Burglar alarm.
Alumina, making, K. J. Bayer ... 515,895
Amalgamating silver ores, A. Janin ... 516,055
Ammonia, manufacturing, H. A. Frasch ... 515,909
Ammonia still, A. Ellis ... 516,154
Annealing apparatus, C. W. Bildt ... 515,813
Armature for dynamo-electric machines, Waddell & Entz ... 516,170
Bag. See Traveling bag.
Bait and fishing tackle box, combined, E. T. Breithaupt ... 515,899
Baling press, Clark & Myers ... 515,748
Baling press, M. C. Nixon ... 515,786
Band machine, J. Welker ... 516,141
Bandage, ear, A. Thamm ... 516,135
Banjo tail piece, E. D. Son ... 516,125
Bar. See Grate bar.
Basin clamp, H. Mueller ... 515,836
Battery use, automatic switch for storage, T. A. Willard ... 516,038
Beams, machine for cutting sections of metallic, Cameron & Snape ... 515,746
Beam separator, E. Knapp ... 515,776
Bed bottom, wire, O. H. Elliott ... 516,047
Bed, spring, D. G. Rollins ... 515,793
Bell, alarm, C. S. Bradley ... 515,991
Bell ringing mechanism, W. H. Durfee ... 516,085
Bicycle, G. W. reeman ... 516,157
Bicycle, F. E. Roberts ... 516,115
Bicycle attachment, W. J. Acheson ... 515,892
Bicycle attachment, B. A. Smith ... 515,800
Bicycle driving gear, V. Cruser ... 516,082
Biscuit making machine, W. Christie ... 516,077
Blowpipes, device for removing moil from, M. J. Owens ... 515,838
Board and cutter, combined, A. H. Seaver ... 516,026
Boiler. See Range boiler. Steam boiler.
Boiler water alarm, C. A. Hatch ... 515,827
Bolt. See Flour bolt.
Book, A. C. Nisson ... 515,872
Boot or shoe stretcher, R. T. Bear ... 515,857
Bottle, R. B. Yerby ... 516,006
Bottle lock stopper, J. A. Shephard ... 516,027
Bottle stopper, valve, N. F. T. Hunt ... 515,879
Box. See Folding box. Signal box.
Box closure, R. W. Johnson ... 515,865
Brake. See Flywheel band brake. Wagon brake.
Brake, W. Schmid ... 516,122
Bread tray and rolling board, combined, T. Collins ... 515,858
Brick from city refuse, manufacture of, E. L. Ransome ... 516,112
Brick machine, N. B. Rice ... 516,023
Brick or tile cutting table, J. D. Fate ... 515,934
Bridge gate, G. Laut ... 515,834
Bridge gate, G. F. Ryan ... 516,121
Brush cutting machine, Kelly & Halloway ... 515,866
Bucket, oyster, W. E. Crume ... 515,820
Buckle, trace, G. V. Martin ... 515,780
Building construction, E. L. Ransome ... 516,111
Burglar alarm, A. N. Woodard ... 515,851
Burner. See Gas burner. Hydrocarbon burner. Vapor burner.
Can body making machine, C. M. Symonds ... 516,033
Can opener, C. H. Winchester ... 515,983
Capstan, W. H. Harfield ... 515,935
Car chair, E. Pynchon ... 516,110
Car coupling, A. L. Croft ... 515,933
Car coupling, S. Crowell ... 515,750
Car coupling, H. Deitz ... 515,903
Car coupling, J. A. Gendron ... 516,158
Car coupling, B. Halstead ... 515,765
Car coupling, R. Haub ... 515,771
Car coupling, I. N. Hinshaw ... 515,830
Car coupling, C. W. Hinton ... 515,864
Car coupling, T. J. W. Howard ... 516,159
Car coupling, D. W. Lawhon ... 516,099
Car coupling, Schmitz & Wallmann ... 516,123
Car coupling, P. Sweeney ... 515,803
Car doors, means for operating dumping, N. Barney ... 515,853
Car, express, F. D. Gildersleeve ... 516,007
Car fender, street, R. C. Lothrop ... 515,868
Car replacer, C. W. Archer ... 515,946
Car seat, railway, J. Krehbiel ... 515,832
Car sea, reversible, J. Lemman ... 515,936
Car unloading device, G. H. Hulett ... 516,053
Car ventilator, T. L. Merrill ... 516,038
Cards, pack of playing, A. I. Paine ... 516,165
Carpet stretcher, J. Cooper ... 515,905
Carrying apparatus, J. G. Delaney ... 516,084
Case. See Piano or organ case.
Cash recorder, C. W. Wilson ... 516,039
Cash register, Hare & Cook ... 515,766
Casket clamp for hearses, G. F. Baird ... 516,172
Casting frames for fence ratchets, pattern for, J. Stauffer ... 516,031
Cement compound, C. J. Everett ... 515,757
Chains, machine for making sheet metal, R. W. Jorres ... 515,961
Chair. See Car chair.
Chair seat, A. Evans ... 516,003
Check hook eye, C. H. Shultz ... 515,798
Chimney, C. E. S. Dunlevy ... 515,860
Cigar, E. Hotz ... 515,774
Cigar holder, R. D. Gates ... 515,825
Clamp. See Basin clamp. Casket clamp.
Clasp, G. N. Buck ... 515,950
Cleaner. See Dish cleaner.
Clipper, hair, J. K. Priest ... 516,109
Clock pendulum, O. Bartel ... 515,855, 515,856
Clothes line attachment, E. J. Van Wormer ... 516,068
Clothes wringer gear casing, W. I. Gong ... 515,910
Coach steps, making, B. D. Druen ... 515,954
Comb. See Curry comb.
Communion service, J. G. Thomas ... 516,065
Compound engine, E. Schwoerer ... 515,975
Concrete construction, E. L. Ransome ... 516,113
Condenser, exhaust steam, J. A. Dillon ... 515,874
Cooker, steam, J. A. Kendall ... 515,880
Corpses, apparatus for the preservation of, V. E. Cohen ... 515,994
Corset, B. Epperly ... 515,824
Coupling. See Car coupling. Hose coupling. Water closet coupling.
Crank, C. Tyler ... 516,137
Cultivator, H. D. Sabin ... 515,843
Curling iron heater, Fowler & Taylor ... 516,004
Current motor, alternate, W. Stanley, Jr., *et al* ... 515,977
Current motor, alternating, C. E. L. Brown ... 515,900
Current motor, alternating, J. F. Kelly ... 515,962
Curry comb, F. C. Ives ... 516,160
Curtain holding device, Piper & Davis ... 515,924
Cutter. See Fruit cutter. Gear cutter. Veterinary tooth cutter. Weed cutter.
Cycle saddle seat, C. L. Pepper ... 515,966
Dental engine, A. W. Browne ... 515,816
Desk attachment, school, C. M. Amerman ... 515,735
Dish cleaner, W. I. McCausland ... 516,103
Distilling and refining volatile substances and essential oils, process of and apparatus for, A. M. Todd ... 515,889
Door check, R. Orr ... 515,923
Door fender, adjustable, I. A. Ritz ... 515,792
Draughting table, J. H. Fry ... 516,089
Dray stake pocket, E. J. Schurmeier ... 515,796
Dredging apparatus, C. Gullmann ... 516,090
Dredging machine, G. H. Titcomb ... 516,066
Drill holding machine, automatic, Pendergrass & Rice ... 516,063
Drilling machine, W. F. Barnes ... 516,150
Drilling machine, C. H. Baush ... 515,988, 515,989
Drying apparatus, Larsson & Bergstrom ... 515,913
Duplicating apparatus frame, E. S. Walker ... 516,139
Dust collector, M. Harmon ... 515,767
Dust collector, G. S. Wilson ... 516,171
Dye, polyazo, J. J. Brack ... 515,89?
Dye, red azo, A. G. Green ... 515,764
Electric cable, T. J. Dewees ... 515,822
Electric cable joint, T. C. Loe ... 516,161
Electric circuit breaker, D. S. Schureman ... 516,025
Electric current regulator, E. E. Ries ... 515,970
Electric currents, portable regulator for, E. E. Riess ... 515,971
Electric lighting system, H. J. Wells ... 515,806
Electric machine, dynamo, J. E. Maynadier ... 515,882
Electric motor, G. S. Dunn ... 515,755
Electric wire splice covering, T. J. Dewees ... 515,905
Electrical apparatus, regulating socket for, E. E. Ries ... 515,969
Electrical heater, A. Cochrane ... 516,152
Elevator, R. J. Mellus ... 515,781
Elevator controlling device, W. F. Cole ... 515,930
Embroidering machine, J. Fischel ... 516,155
Enameled ironware and process of enameling, A. J. Vollrath ... 515,981
Engine. See Compound engine. Dental engine. Gas engine. Rotary engine. Steam engine.
Envelope, G. C. Billups ... 516,045
Escapement wheel, duplex, H. J. Eisen ... 515,862
Escapement wheels, making duplex, H. J. Eisen ... 515,861
Fan, suspension fly, J. L. Saxe ... 515,972
Fare box money changer, Muth & Martin ... 515,920
Fare register, C. Crook ... 516,081
Fare register, E. T. Taylor ... 515,888
Faucet, W. Wrigley ... 515,810
Fence wire stretcher, Wyssinger & Baer ... 516,040
Fence wire tightener, I. K. Hollinger ... 515,936
Fender. See Car fender. Door fender.
File and scissors, combined nail, W. W. Hayden ... 515,828
Filler, H. Schneider ... 515,884
Filter, H. R. Kuersten ... 515,833
Filter, W. Weir ... 516,140
Filter, feedwater, A. Harris ... 515,768, 515,769
Filtering apparatus, W. Balz ... 515,894
Fire escape, S. H. Roper ... 516,116 to 516,118
Fire extinguisher, O. A. Stempel ... 515,846
Fire extinguisher, automatic, McLauthlin & Naylor, Jr. ... 515,938
Fire generator, A. Mistaro ... 51 ,782
Fireplace furnace or heater, open, G. R. Scates ... 515,942
Fish spear, J. D. Dreese ... 515,875
Flies on animals, trap for, R. H. Guthrie ... 516,048
Floor washing machine, J. C. Garrott ... 515,877
Flour bolt, S. D. Barr ... 515,812
Flushing apparatus, W. A. Everha ... 516,002
Flywheel band brake, L. Luckhardt ... 515,915
Folding box, S. F. Sherman ... 516,124
Folding table, R. Ettinger ... 515,955
Food compound, J. J. Angus ... 515,736
Form, adjustable draping, A. B. Buehl ... 516,151
Fountain, E. D. Brainard ... 515,898
Frame. See Duplicating apparatus frame. Purse or bag frame. Screen frame.
Fruit cutter and press, F. D. Ridge ... 51 ,791
Fruit picker, G. W. Armstrong ... 515,852
Fuel feeding, measuring and regulating device, automatic, W. H. Cooke ... 515,932
Furnace. See Fireplace furnace. Hot water furnace.
Furnace, R. H. Laird ... 515,867
Furnace for roasting and distilling refractory ores, A. Spier ... 516,126
Furniture, combination, C. B. Geer ... 516,005
Gaming machine, R. J. Laidlaw ... 515,912
Games, score card for football, A. A. Irwin ... 515,909
Gas burner, R. Pemberton ... 516,107
Gas burner, automatic, G. I. Ewers ... 515,758
Gas burner heating attachment, E. Copland ... 516,153
Gas burner lighting device, G. I. Ewers ... 515,759
Gas engine, Hartley & Kerr ... 515,770
Gate. See Bridge gate. Swinging gate.
Gear cutter, multiplex, U. & H. E. Eberhardt ... 515,906
Generator. See Fire generator.
Glove fastener, G. E. Danforth ... 515,873
Governor, engine, H. Aspinall ... 516,041
Governor, steam engine, S. P. Lathrop ... 515,964
Grain heading machine, F. W. Nessly ... 515,971
Grain meter, oscillating, D. Wilde ... 516,143
Grate bar, F. J. St. John ... 515,847
Grinding and polishing machine, C. F. Roper ... 516,168
Hair curler, E. Doucher ... 515,998
Hairpin, T. Caldwell ... 515,745
Hame hook, W. J. Dankworth ... 515,997
Hammer, drop, E. W. Merrill ... 515,919
Hanger. See Pipe hanger. Trolley wire hanger.
Harmonica, month, G. Kaiser ... 516,096
Harvesting or planting pouch, King & Truitt ... 516,097
Hat, ventilated, C. H. Davies ... 516,083
Hatchway, self-closing, W. R. Wemple ... 516,037
Hay curling machine, K. Wessel ... 515,891
Hay loader, N. O. Henderson ... 515,773
Heater. See Curling iron heater. Electrical heater. Hot air and hot water heater. Portable heater.
Heating apparatus, electric, A. E. Appleyard ... 516,071
Heating apparatus, hot air, S. H. La Rue ... 516,017
Heating apparatus, hot water, J. C. Norton ... 516,051
Heel nail, G. A. Curtis ... 515,962
Hitching post, L. W. Cline ... 515,818
Hollow articles, apparatus for manufacturing, M. A. Jouet-Pastre ... 516,056
Hook. See Hame hook.
Horseshoe, Z. Birdsall ... 516,046
Hose coupling, R. F. O'Meara ... 515,788
Hose fastening, A. L. Baily ... 515,893
Hot air and hot water heater, combined, A. C. Mott ... 516,069
Hot water furnace, A. C. Mott ... 516,102
Hub attaching device, S. Robinson ... 515,842
Hydraulic motor, E. C. Nichols ... 516,164
Hydrocarbon burner, W. H. Ames ... 516,069, 516,070
Hydrocarbon burner, P. J. Mullaney ... 515,837
Ice breaker for tugs, etc., L. C. Bovy ... 515,739
Ice cream freezer, J. W. Woodward ... 516,145
Ice rink, E. De Stoppani ... 515,979
Implement, compound pocket, J. C. Schlarbaum ... 515,973
Incandescent elements, composition for, Crawford & Bohm ... 516,080
Incandescent elements, making, Crawford & Bohm ... 516,079
Index purposes, slip cutter for, A. J. Rudolph ... 516,119
Indicator. See Street or station indicator.
Insulator, strain, H. H. Luscomb ... 515,779
Ironing table, J. M. Moore ... 515,869
Jack. See Wagon jack.
Jar holder, J. A. Parry ... 516,166
Joint. See Electric cable joint. Railway rail joint.
Joints, means and method of maintaining tight, E. Stowell ... 515,887
Keyhole guide, J. L. Easley ... 516,086
Kiln. See Malt kiln.
Knife. See Pocket knife. Table knife.
Knives or kindred articles of cutlery, making, E. C. Lombard ... 515,835
Knitting machine, straight, Wilson & Hutchinson ... 516,144
Knitting machines, electric stop motion for, A. A. Merritt ... 515,965
Lacing fastener, shoe, S. J. Simmons ... 515,844
Ladder, extension, J. B. Moore ... 515,783
Lamp, electric arc, J. J. Wood ... 515,850
Lamps, automatic cut-out for incandescent, E. H. Johnson ... 515,960
Latch, H. Arnet ... 515,985
Lead press, H. B. Cobb ... 515,951
Leaf turner, A. W. Gitchell ... 516,008
Level and key seat rule, F. Schaefer ... 516,024
Levels, adjustable index for spirit, H. Wheeler ... 516,142
Lifter. See Plate lifter.
Liquors, apparatus for cooling and aerating, P. Hildenbrand ... 515,829
Lock. See Nut lock.
Logs, rossing, E. C. Hargrave ... 516,091
Loom harness motion, J. Magee ... 516,163
Loom shedding mechanism, G. W. Stafford ... 516,169
Loom shuttle, O. Piper ... 516,108
Looms electrically, apparatus for forming sheds in, J. Kauffmann ... 51 ,775
Lubricator, J. F. Evans ... 516,087
Lubricator, M. F. Nester ... 516,104
Malt kiln and method of drying malt, W. H. Prinz ... 515,840
Malting grain, method of and apparatus for, W. H. Prinz ... 515,841
Mangle, J. G. Crawford ... 515,996
Match stick bunching machine, E. H. Eisenhart ... 515,756
Metal working, electric, Lemp & Moody ... 515,778
Meter. See Grain meter.
Mill. See Rolling mill.
Mine door, G. D. Warren ... 516,036
Mirror, G. L. Hills ... 516,092
Mould. See Rubber mould.
Mortising machine, D. Hepp ... 516,014
Motor. See Current motor. Electric motor. Hydraulic motor. Toy motor. Wave motor.
Mower, rotary lawn, A. B. Schermerhorn ... 515,795
Mowin machine attachment, W. Storey ... 515,802
Nail. See Heel nail.
Nut lock, B. F. Sweet ... 515,848
Nut polishing or edging machine, G. Dunham ... 515,754
Oiler for shafting, mechanical, G. H. Cole ... 515,749
Ore concentrator, C. G. Pingel ... 516,121
Organ, pipe, E. Howard ... 515,967
Package for goods, J. W. Kirkpatrick ... 515,881
Pad. See Pouncing pad.
Paddlewheel, boat, N. Pelletier ... 515,883
Pamphlet stapling machine, D. A. Flavell ... 516,156
Paper holder, roll, S. Wheeler ... 515,849
Paper mill stuff chest, E. L. Savage ... 515,941
Paper pail making machine, E. Hubbard ... 515,958
Pavement, artificial stone, P. M. Bruner ... 515,901
Penholder finger rest, M. Goetze ... 516,009

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Phonograph mandrel, A. D. Andrews..... 515,811
Photographic apparatus, coin-controlled, J. W. Burton..... 516,076
Piano or organ case, upright, W. T. Smith..... 515,526
Picker. See Fruit picker.
Pin. See Hairpin.
Pipe drilling and tapping tool, M. F. Smith..... 515,976
Pipe hanger, steam, S. O'Brien..... 515,922
Pipe nipples, device for holding, T. Gibney..... 515,826
Planter furrow closing attachment, corn, A. W. Trotter..... 516,067
Plate lifter, A. W. & H. L. Burnham..... 515,902
Plow, M. P. M. Davis..... 515,752
Plow, R. Finot..... 515,876
Pocket knife, B. Von Bultzingslowen.....515,742, 515,743
Polishing machines, article holding table for, F. H. Barnard..... 515,986
Portable heater, J. Graves..... 516,010
Post. See Hitching post.
Pouncing pad, flexible, G. E. Brush..... 515,992
Power, electrical transmission of, C. F. Scott..... 515,885
Preserving food by cold, etc., F. M. Peck..... 515,789
Press. See Baling press. Lead press.
Press for veneers, etc., J. J. Hayes..... 516,012
Printer's chase, J. W. Osborne..... 516,106
Printing machine, multicolor, J. L. Davies..... 515,821
Printing presses, adjustable roll for, P. Splithoff.. 516,127
Pulley, differential, L. Kleritj..... 516,098
Pump, J. S. Losch..... 516,162
Pump, air compressor beer, J. Braun..... 515,740
Punching and pinking machine, E. B. Stimpson.. 515,927
Purse or bag frame, Mergott & Hiering..... 515,918
Puzzle, H. Walton..... 516,035
Radiator, electric, S. B. Jenkins..... 516,095
Railway rail joint, Muehlfeith & Ibel..... 515,785
Railway signal, E. W. Harden..... 516,049
Railway signal, R. S. Wiles.....515,807, 515,808
Railway switch, E. W. Harden..... 516,050
Railway switch, shifting, H. E. Lowe..... 516,100
Railway tie, J. Dyson..... 516,001
Range boiler, G. Booth..... 516,073
Recorder. See Cash recorder. Time recorder.
Register. See Cash register. Fare register.
Regulator. See Electric current regulator.
Ribbon holder, A. E. Hartzell..... 516,051
Roads, machine for making or repairing, M. G. Bunnell..... 515,744
Rod. See Violoncello rod.
Roller. See Shade roller.
Rolling mill, continuous, W. H. Maddock..... 515,917
Roofs or masonry, composition of matter for coating, J. Daymon..... 515,859
Rotary engine, R. Z. Pooler..... 516,022
Rubber mould or pattern and manufacturing same, M. Smith..... 516,028
Rubber moulds and patterns, apparatus for the manufacture of, M. Smith..... 516,029
Rule, calculating, E. F. Steck..... 515,978
Sash cord guide, C. Wolcott..... 515,809
Sash holder, J. F. Bjurlund..... 516,173
Scaffold, E. Bonnlender..... 515,738
Scale, hydrostatic, J. H. Digeon..... 515,753
Scraper, road, W. H. Diedrick..... 515,999
Scraper, wheeled, J. R. Williams..... 515,982
Scrapers, lock and dumping mechanism for wheeled, A. F. Bernard..... 516,044
Screen frame for windows, etc., A. Braun..... 515,814
Screw, R. Stilwell..... 516,134
Seal, W. L. Carr..... 515,747
Sealing device, bottle, G. A. Boyden..... 515,990
Seat. See Car seat. Chair seat. Cycle saddle seat.
Seeding machine, A. Lindgren..... 516,019
Separator. See Bean separator.
Sewing machine, A. E. Lindner..... 516,020
Shade roller, D. Lauer..... 516,018
Sharpening razors, shears, etc., machine for, C. A. Worden..... 516,146
Shutter bower, R. Zoll..... 516,148
Sign, fence, J. W. Wilson..... 515,945
Sign, street car, Rauch & Keith..... 515,967
Signal. See Railway signal. Switch signal.
Signal box, electric, T. F. Gaynor..... 515,762
Signaling and communication, system for, T. F. Gaynor..... 515,761
Sleigh, bob, J. H. Jackson..... 516,094
Smokestack hood, Peirce & English..... 516,062
Soda crystals, making, H. R. Browne..... 516,075
Spinning spindle supporting device, R. Atherton. 516,042
Spring. See Treadle spring.
Stamp mill mortar, H. Bolthoff..... 515,896
Stay, dress, F. W. Lyon..... 515,916
Stay, dress, E. B. Taylor..... 515,804
Steam boiler or generator, C. D. Mosher..... 515,784
Steam by electricity, apparatus for generating, Rider & Lewis..... 516,167
Steam engine, E. Shydecker..... 516,064
Steam generating apparatus, H. McPhail..... 516,060
Steam generator and heating apparatus, Fisher & Partridge..... 516,088
Steam, tube for superheating, E. Schwoerer..... 515,974
Steaming and cleaning grain, apparatus for, J. E. Riley..... 516,114
Steering apparatus, steam, C. H. Hawkins..... 515,772
Stilt step, Packham & Cline..... 515,839
Stock loader, Rotzien & Arnold..... 515,794
Stone polishing machine, A. F. Spaulding..... 515,801
Stopper. See Bottle stopper. Bottle lock stopper.
Stove, soldering, E. T. Burgess..... 515,993
Street or station indicator, B. Barnett..... 515,929
Structural metal work, A. Krause..... 515,963
Submarine drilling apparatus, T. Symonds..... 516,032
Sulphate lyes, process of and apparatus for purifying, C. Von Grabowski..... 515,763
Swift, yarn, L. M. Hernz..... 516,015
Swinging gate, W. Hemme..... 516,052
Switch. See Railway switch.
Switch, A. P. Odell..... 516,105
Switch signal, electric, T. L. & N. W. Dalton..... 515,751
Switching from main to side tracks, means for, J. B. Buguid..... 515,823
Table. See Brick or tile cutting table. Draughting table. Folding table. Ironing table.
Table, J. Heissenberger..... 516,013
Table knife, R. Krohn..... 515,777
Tack driving implement, M. Brock..... 516,074
Tank. See Water closet tank.
Telegraph repeater, W. E. Sloan..... 515,845
Telephone directory holder, C. C. McCloskey, Jr.. 515,921
Telephone exchange system, E. Pope..... 515,939
Telephone receiver, C. Selden..... 515,797
Telephone system, E. Pope..... 515,940
Tent pole, A. S. Comstock..... 516,078
Thermostat, E. Barney..... 516,043
Thread holder and cutter, D. R. Porter..... 515,790
Tie. See Railway tie.
Time recorder, employe's, N. M. Watson..... 515,805
Tire, pneumatic, J. J. Fox..... 515,908
Toilet sets, supporting frame for, N. O. Bond..... 515,949
Tool, combination, H. W. Smith..... 515,799
Tool or implement holder, L. M. Burbank..... 515,817
Tooth, artificial, C. F. Rutterford..... 516,120
Torpedo wrapper, J. Cook..... 515,931
Toy motor, automatic, H. Hensel..... 515,956
Traction wheel, bicycle or other, C. A. Ives..... 516,054
Transit instruments over physical points, device for centering, C. H. Brightly *et al*..... 515,815
Trap, Turner & Fletcher..... 515,980
Traveling bag, extension, E. W. Thompson..... 515,928
Treadle spring, G. Frank, Jr..... 515,760
Trolley wire hanger, G. Forbus..... 515,907
Trowel, R. Walrath..... 515,890
Truss, G. W. Bell..... 515,948
Upholstery spring support, J. A. Staples..... 516,030
Valve for gas saving regulators, J. C. Richardson 515,968
Valves, etc., automatic regulator for, E. H. C. Oehlmann..... 515,787
Vapor burner, J. S. Wood..... 515,984
Vehicle wheel, A. M. Allen..... 516,149
Vehicle wheel, W. Bonnar..... 516,072
Vehicle wheel, W. H. Detter..... 515,904
Vending machine, Brown & Olcott..... 515,741
Ventilating fire rooms, apparatus for, Aubry & Dawson..... 515,947
Ventilator. See Car ventilator.
Vessels over bars, device for floating, Hadley & Foster..... 515,878
Veterinary tooth cutter, H. C. Stanbridge..... 515,943
Violin mute, H. W. Hoeft..... 516,093
Violoncello rod, W. H. Howe..... 515,831
Wagon brake, W. Manworing..... 516,101
Wagon, dumping, N. Barney..... 515,854
Wagon, dumping, J. Bauers..... 515,987
Wagon, garbage, Hubbell & Gilbert..... 515,911
Wagon jack, L. L. Kellogg..... 516,057
Washing machine, R. R. Stevenson..... 515,944
Water closet, S. W. Lewis..... 515,914
Water closet, H. C. Stifel.....515,886, 516,128 to 516,132
Water closet bowl, H. C. Stifel..... 516,133
Water closet coupling, J. J. Ricketts..... 515,925
Water closet tank, P. Harvey..... 516,011
Water purifying apparatus, T. Craney..... 515,819
Wave motor, J. C. Walker..... 516,034
Weed cutter, J. F. Dole..... 516,000
Weighing and registering machine, W. B. Dickson..... 515,953
Wheel. See Escapement wheel. Paddlewheel. Traction wheel. Vehicle wheel.
Windmill, T. Forstner..... 515,863
Wire reeling truck, J. Nagel..... 515,870
Wire spool or reel, C. Beck..... 515,737
Wrapping machine, S. D. Tripp..... 516,136
Yarn or thread into carriers, mechanism for drawing, Wyman & Clark..... 516,147
Yoke center, neck, E. M. Van Valkenburg..... 516,138
Zinc ores, treatment of, Ingalls & Wyatt..... 516,016

DESIGNS.

Bottle, Fay & Schueler..... 23,100
Box, ornamental, E. L. Edes..... 23,102
Cape, J. Adler..... 23,094
Carpet, A. M. Rose..... 23,092
Game board, W. A. Wells..... 23,101
Gum, tablet of chewing, G. M. Harsh..... 23,096
Handkerchief, etc., P. Cox..... 23,093
Music leaf turner, R. B. Shaw..... 23,103
Refrigerators, removable side flue for, G. W. Lawrence..... 23,105
Shirt, J. F. Quinn..... 23,095
Siding board, G. R. Boyd..... 23,106
Spoon, E. W. Campbell..... 23,097
Spoon, B. B. Freeman..... 23,098
Spoon, C. B. Peets..... 23,099
Tool rack, T. R. Callan..... 23,104
Type, font of printing, J. West..... 23,107

TRADE MARKS.

Ammonia, benzine, and turpentine, R. H. Macy & Company..... 24,290
Beverages, carbonated, J. J. McLaughlin..... 24,311
Bread, J. Schmalz & Son..... 24,307
Brooms and brushes, Robinson & Ebert..... 24,288
Brushes, varnish, C. K. Van Rensselaer..... 24,289
Cakes, crackers, and biscuits, E. Ivins..... 24,308
Canned goods, Bennett, Sloan & Company...24,302, 24,303
Canned meats, fish, fruits, spices, condiments, and vegetables, except corn, Bennett, Sloan & Company..... 24,301
Cotton duck, Woodberry Manufacturing Company 24,287
Cotton goods, woven, Massachusetts Cotton Mills, 24,285, 24,286
Enameled steelware for household use, Bellaire Stamping Company..... 24,324
Face powder, H. Tetlow..... 24,297
Flour, wheat, F. S. Johnson & Company..... 24,306
Hams, bacon, shoulders, and all smoked hog, beef, and mutton products, Jacob Dold Packing Company..... 24,299
Hams, beef, bacon, and tongues, cured, J. H. Michener & Company..... 24,300
Hardware, saddlery, Wiener & Company..... 24,326
Medicinal purposes, chemical compound for, New York and London Alkaloid and Chemical Company..... 24,317
Mineral spring water, Lenape Springs Company... 24,312
Mustard, C. Gulden..... 24,298
Pharmaceutical product, L. Durand, Huguenin & Company..... 24,315, 24,316
Pills, H. Robinson..... 24,323
Preparation for female diseases, done up in a ball and wrapped in tin foil, C. E. Langworthy..... 24,321
Preparation for the cure of gonorrhea, E. D. Phillips..... 24,322
Refrigerators, D. Eddy & Sons..... 24,325
Remedies for diseases of the stomach and bowels, Sultan Drug Company..... 24,320
Remedy for coughs, colds, consumption, and other diseases of the throat and lungs, E. H. Fienhold..... 24,318
Remedy for indigestion, dyspepsia, and similar affections, F. R. Butterfield..... 24,319
Soap, Castile, California Olive Oil Soap Company.. 24,293
Soap in cakes or bars, Christopher Lipps Company 24,292
Soap, shaving, J. B. Williams Company.....24,294, 24,295
Soap, toilet, J. B. Williams Company..... 24,296
Stays, dress, T. P. Taylor..... 24,284
Tea, G. Lockitt's Sons..... 24,305
Tea, R. H. Macy & Company..... 24,304
Tonic, Hazard, Hazard & Company..... 24,313
Whisky, A. Usher & Company..... 24,309
Wines and champagnes, E. Pommer..... 24,310
Witch-hazel distillate, Connecticut Witch Hazel Company..... 24,314
Wool, cleansing compound for scouring raw, E. D. Rice..... 24,291

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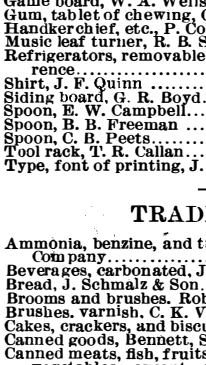
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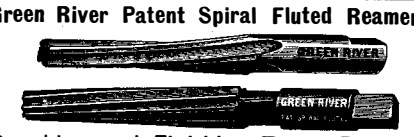
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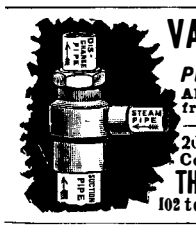
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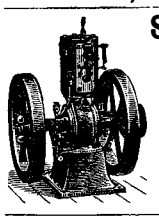
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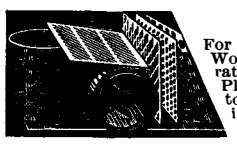
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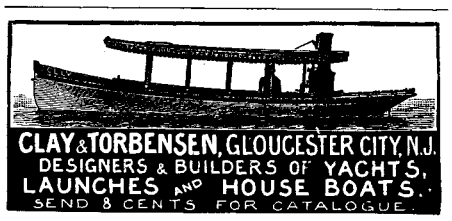

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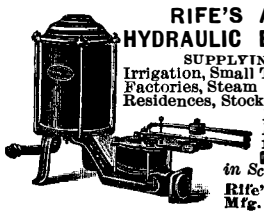
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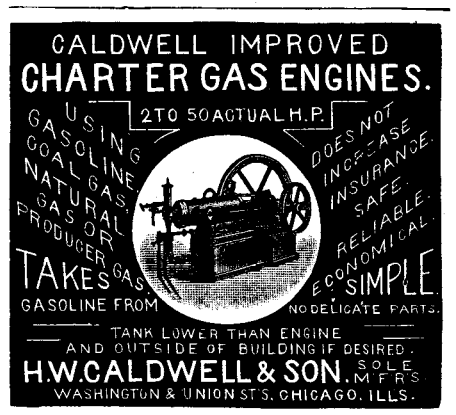
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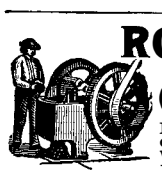
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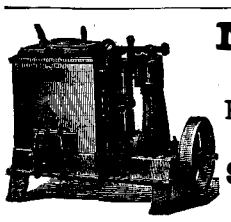
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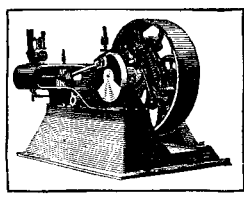

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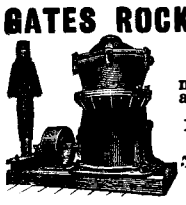

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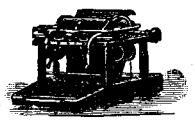

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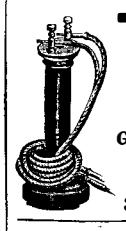

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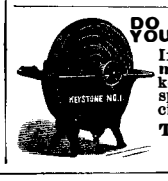

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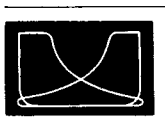

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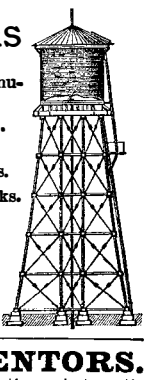

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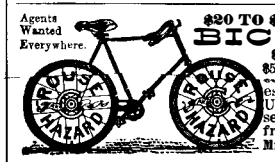

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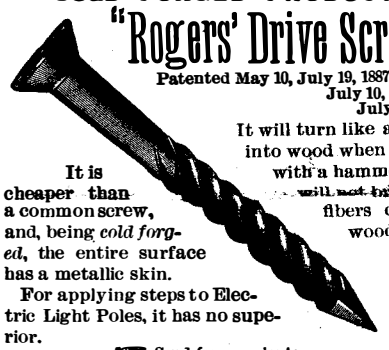

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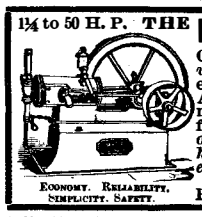

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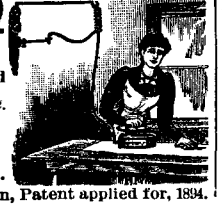

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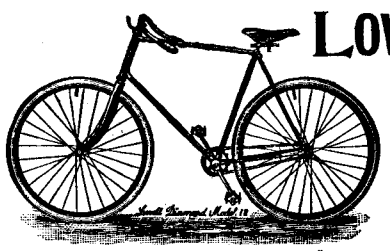

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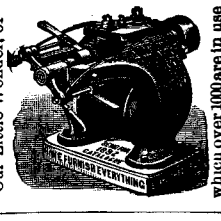

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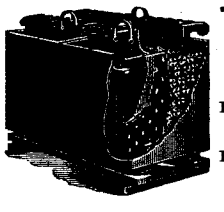

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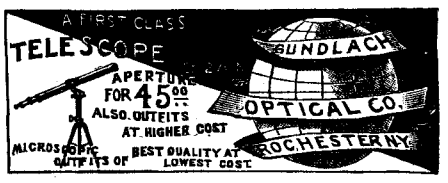

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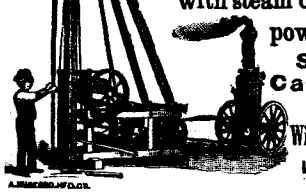

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